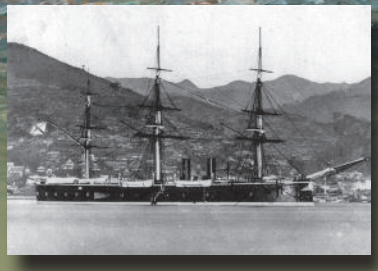
EUROPEAN IRONCLADS 1860–75

The *Gloire* sparks the great ironclad arms race



ANGUS KONSTAM

ILLUSTRATED BY PAUL WRIGHT

NEW VANGUARD 269

EUROPEAN IRONCLADS 1860–75

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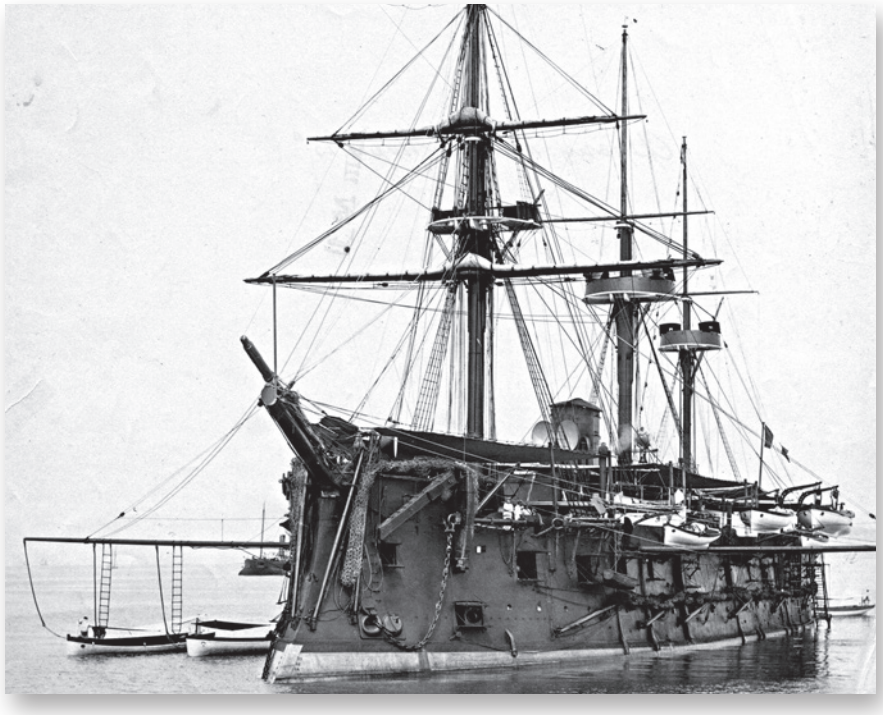

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EUROPEAN IRONCLADS 1860–75

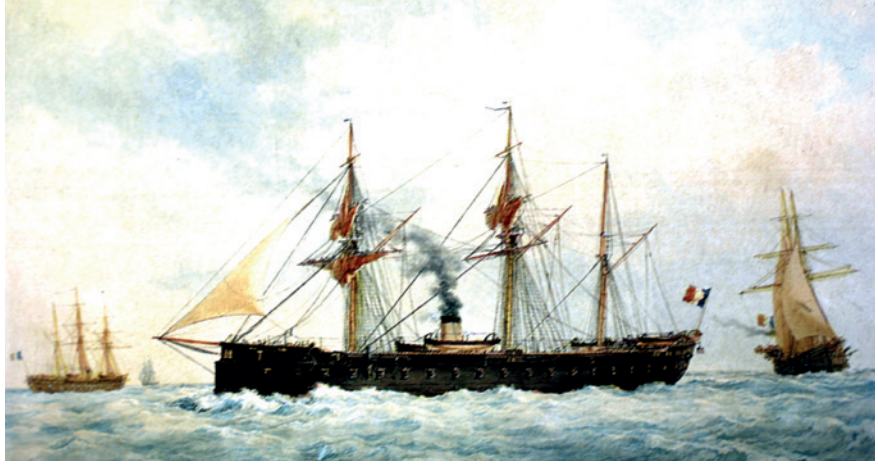
The *Gloire* sparks the great ironclad arms race

INTRODUCTION

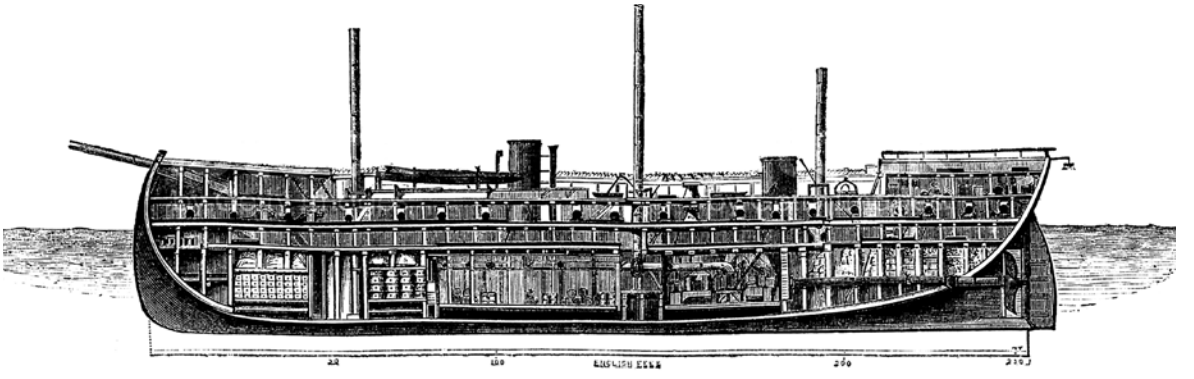
In November 1859, the French 'ironclad' *Gloire* (Glory) was launched in Toulon. She was the world's first seagoing ironclad – a warship built from wood, but whose hull was clad in a protective layer of iron plate. While history best remembers the ironclads of the American Civil War such as the *Monitor* and the *Virginia* (formerly the *Merrimac*), these American warships were dwarfed by the far larger and more powerful oceangoing ironclads entering service in European navies. The American ships' place in history lay in the fact that they were the first ironclads to fire their guns in anger.

The *Gloire* was followed by a succession of other French ironclads, for the most part built along similar lines. Other European powers, not wanting to be outdone, built or ordered their own iron-plated warships. Again, although the British *Warrior* is the best known of these as she still survives, similar ironclads were appearing in other European navies, some of which were based on startlingly innovative designs. Together these European ironclads embodied the startling technological advances of the late 19th century, and the spirit of this new age of steam, iron and firepower.

The *Gloire* and her immediate successors were all 'broadside ironclads', with their guns arrayed in long batteries, much as they had been during the age of fighting sail. The next generation were 'casemate ironclads', where



The *Gloire*, the French ironclad warship which rendered the world's navies obsolete, was actually of fairly conventional design, with a wooden hull clad in iron plate, and an armament, propulsion and rigging similar to other wooden-hulled French warships of the period.



The armoured belt of the *Gloire* extended from stem to stern, protecting her machinery spaces and magazines below the waterline as well as her gun deck above it. However, as a pioneering vessel she had her problems – her poor centre of gravity meant that she rolled badly, and the weight of her armour placed undue stress on her timber hull.

a smaller battery of heavier guns was concentrated inside a well-protected armoured box. While the French were slow to embrace them, other navies developed 'turret ships' – larger versions of the USS *Monitor*, where big guns were housed inside rotating armoured turrets. Each major European navy developed ships designed to suit its own particular needs.

Although most of these ships never fought an action, a few European ironclads did. In 1864, for instance, the Danish turret ironclad *Rolf Krake* duelled with Prussian shore batteries during the Prusso-Danish War. Two years later, at the battle of Lissa, Italian and Austro-Hungarian ironclads clashed in what was the largest sea battle of the ironclad age. The experience gained from these engagements led naval architects up some blind alleys. An example of this was the continued use of the ram, an anachronistic throwback to the galley tactics of the Ancient world. However, it highlighted the way forward. For instance, in both clashes the turret proved its worth, and this, more than anything, represented the future of naval warfare.

This book follows developments in ironclad design and construction in all the major European navies of the period apart from the British Royal Navy, whose ironclad fleet was powerful enough to warrant its own book (New Vanguard 262 – *British Ironclads 1860–75*). This whole naval revolution, and therefore the ironclad era, began on a slipway in Toulon in 1858, when work on the world's first oceangoing ironclad got under way.

DESIGN AND DEVELOPMENT

On the morning of 17 October 1855, a line of Anglo-French steam-powered warships opened fire on the Russian fort at Kinburn, guarding the mouth of the River Dniepr. Supporting them were three ungainly floating batteries, the *Dévastation*, *Lave* and *Tonnante*. The brainchild of the French emperor Napoleon III, these 1,575-ton wooden-hulled and iron-plated batteries were little more than rafts, and their tiny engines were only there to help them maintain their position. They had to be towed into place by other more powerful vessels. Unlike the proper warships of the Anglo-French fleet, though, their wooden hulls were protected by 4in (10.2cm) of wrought-iron plate. Each carried 16 7.1in (18cm) 50-pdr smoothbore guns. During the bombardment they fired almost 3,000 rounds at the fort, while the Russian shot bounced off their ironclad hulls.

The *Lave* seen here was one of three floating batteries built in France during the Crimean War (1853–56). She was wooden hulled, but clad in wrought-iron plate. She had to be towed into position by steam-powered vessels. Her success, though, led to the development of a self-powered ironclad vessel.

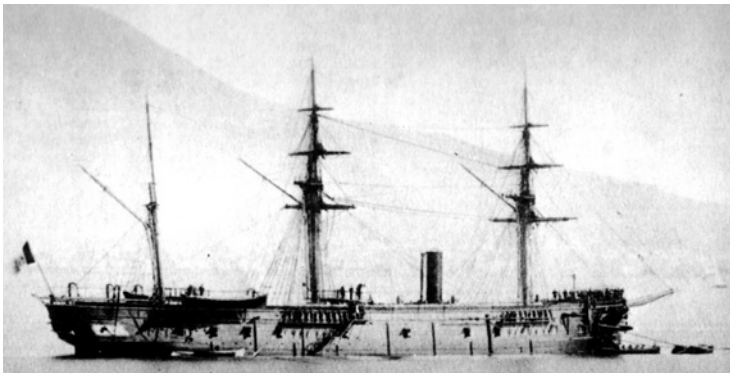
It has been argued that the real damage to the fort that day was caused by Allied mortar vessels, but the performance of the floating batteries impressed the British Admiralty sufficiently to order some of their own. More importantly, the French emperor was delighted, and this led directly to the next logical step – the creation of a fully fledged seagoing ironclad warship. The emperor's first move was to find a naval architect who could design such a revolutionary ship. On 1 January 1857, Napoleon appointed Henri Dupuy de Lôme (1816–85) as the new Director of Construction for the French navy. He was the man who had built the *Napoléon*, France's first purpose-built steam-powered ship-of-the-line, commissioned in 1852. Her designer would soon render the *Napoléon* obsolete.

The first ironclad

The French Navy accepted that change was coming. After the Kinburn bombardment they ordered no successors to the *Napoléon*, and experiments began on different types of armoured protection. Dupuy de Lôme realized that he was constrained by the limitations of French industry. While he was a staunch advocate of iron-hulled ships, he recognized that to build such a vessel from scratch would be time-consuming, technically challenging and most importantly beyond the current technological capabilities of French iron foundries. So, while he encouraged French industrialists to develop ways to produce thicker and more resilient wrought iron, he reluctantly accepted the need to build his first ironclad as a wooden-hulled warship. What would transform her, after all, were the wrought-iron plates attached to the outside of her hull.

Essentially, this ironclad, to be called the *Gloire*, would be a wooden-hulled steam-powered battleship not unlike the *Napoléon*, only one that would have her hull cut down to a single gun deck. Her hull would then be covered with 4.3–4.7in (10.9–12cm) thick plates of wrought iron, which would be bolted to the outside of her wooden hull. Internally her wooden hull would be braced with iron frames and deck beams to support the weight of this armour, and her upper deck would also be given a thin armoured plating, beneath her wooden deck planking. The iron-plated hull would be pierced with gun ports to create a single-decked broadside battery of 17 6.4in (16.3cm) rifled muzzle-loading guns (RMLs) per side, with two more mounted on her upper deck. In theory, thanks to the ship's armour, this battery would be completely invulnerable to enemy

Even before the *Gloire* entered service the Italians were planning to build an ironclad fleet of their own. The *Messina*, shown here, was one of three in her class – the first batch of ironclads built in Italy. Like her sisters she was converted from a wooden-hulled frigate.



fire. The ironclad would be powered by a single screw, driven by a horizontally mounted steam engine powered by eight boilers.

Gloire would also carry three masts fitted with a light barquentine rig, although this was later changed to a more substantial sailing rig in an attempt to improve her lacklustre sailing qualities. In her sea trials it was found that the *Gloire* sat low in the water, with her gunports just 6ft 6in (2m) above the waterline. Her metacentric height, a useful measure of her stability, was high at 7ft (2.1m), which meant that she was prone to rolling uncomfortably in a rough sea. Interestingly, the iron-hulled *Couronne* proved to be a more stable design.

These, though, were all relatively minor problems. What really set *Gloire* apart from all other warships was her armour. During her sea trials, French 7.1in (18cm) RMLs were fired at her from close range. None of these shots penetrated her armoured hull. It was also found that she was proof against shots fired from the British equivalent, the 8in (20.3cm) 68-pdr RML. This meant that from August 1860 until the commissioning of HMS *Warrior* 14 months later, Britain's fleet of wooden-hulled steam-powered ships-of-the-line was completely at the mercy of this French ironclad. The *Gloire* had rendered these imposing warships obsolete.

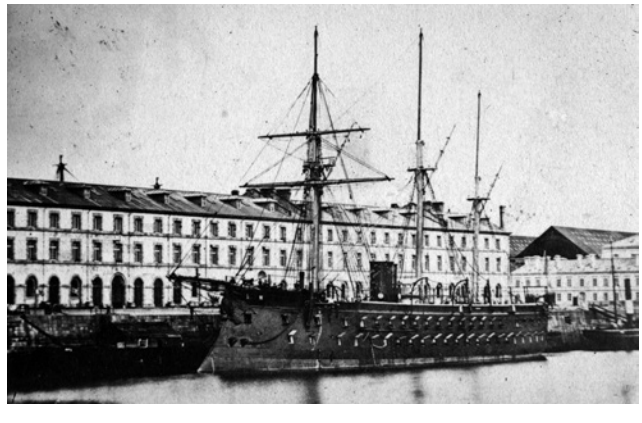
This detail of a 1:33 scale model of the *Gloire* in the Musée National de la Marine in Paris shows the way her armoured plates were bolted to the wooden hull of the ship. In later ironclads these bolts were countersunk, to reduce the risk of them being fractured when hit by an enemy projectile.

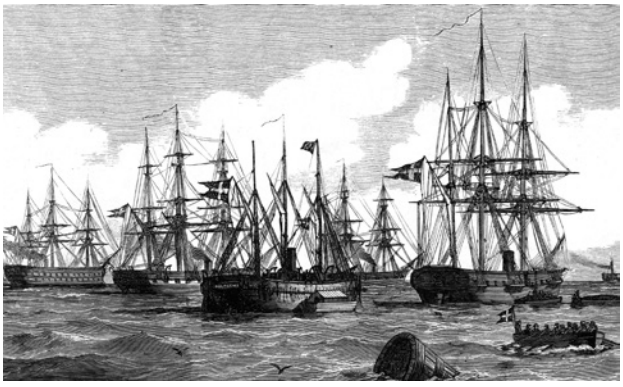
The Magenta class of French ironclads were really armoured ships-of-the-line, with a double gun deck, compared to the single-decked French ironclads which preceded them. The *Solferino*, pictured here soon after she entered service in 1862, eventually had her lower guns removed, and her upper ones replaced with larger pieces.

From broadside to turret

The *Gloire* was described as a 'broadside ironclad'. This meant that, like a warship of the age of fighting sail, her guns – or at least most of them – were mounted so that they fired from gunports cut into the sides of her hull. So, *Gloire* carried 17 guns on each side of her hull, and thus in each broadside. The idea was that the warship would manoeuvre so that her enemy was lying within the arc of fire of one of these two powerful broadsides. It was a tactic that led to the development of the 'ship-of-the-line' – a powerful sailing warship which formed part of a fleet's battle line. A squadron of ships deployed in a line could present the maximum degree of firepower at the enemy. Effectively, the broadside ironclad merely perpetuated a naval design that by 1860 had been in existence for two centuries.

Interestingly, despite being more powerful than any wooden warship, *Gloire* was never called a ship-of-the-line. She was an armoured frigate. The term 'frigate' referred to the sailing 'cruiser' of the age of sail, but essentially its distinguishing feature was that her guns were carried in one single deck. A ship-of-the-line had hers mounted in two or more decks. So, given the way *Gloire* carried her guns, the term 'frigate' continued to be applied, despite the fact that unlike frigates, the *Gloire* and other seagoing ironclads were designed to form the core of a battle fleet, and would





The Danish fleet pictured at anchor off Copenhagen at the start of the Prusso-Danish War (1864). The small turret ship *Rolf Krake* shown in the foreground is the only ironclad – all the other warships are wooden-hulled steam-powered frigates, while on the far left is the steam-powered ship-of-the-line *Skjold*.

operate in the same way as sailing ships-of-the-line had done. Indeed she, and the ironclads which followed her, were destined to serve for the most part in either the French Mediterranean or Channel fleets.

Most of the first generation of ironclads to enter service were broadside ironclads. Then, by the mid- to late-1860s, a combination of technology and tactics made naval designers question this tried and tested approach. In terms of technology, the efficiency of wrought-iron production was improving dramatically, and it became possible to produce thicker iron plates. This meant that ironclads could now be given greater armoured protection. This was tied to a similar increase in both the size and the effectiveness of naval ordnance. Guns were becoming increasingly powerful, and so in theory a smaller number of guns could actually provide a ship with a greater and more effective level of firepower than before.

This in turn raised the possibility of protecting this smaller battery of large guns with thicker armour. In effect, the armour could be concentrated in two places – in a belt above and below the waterline to protect the ship's vitals (her machinery and magazines), and in front of her gun battery. The result was the creation of an armoured citadel or box to protect this battery. Often this was 'squared off' at either end by transverse iron bulkheads, which protected the citadel from raking fire – shot coming in over the bow or stern. Outside this box the armour could be lighter. So, the overall difference to the displacement of a ship would not be significantly increased.

In Britain, where the first of this new style of ironclads were first built, they were called 'central battery' ironclads. In the rest of Europe and the United States, however, the term 'casemate' ironclad was preferred. HMS *Bellerophon*, commissioned in 1866, represented a major step forward in warship design, as she not only employed this configuration and powerful armament, but also combined these features with improved propulsive power and seakeeping qualities. Other European navies reacted by developing their

A

ROLF KRAKE IN ACTION NEAR DYBBØL, 18 FEBRUARY 1864

On 1 July 1863 the small turret ironclad *Rolf Krake* was commissioned into the Danish navy. Built in Clydebank, her wrought-iron-plated hull was 4.5in (11.4cm) thick – the same thickness as the much larger *Gloire* or *Warrior*, albeit with only 8in (20.3cm) of wooden backing. She was schooner-rigged, powered by a single screw, and carried four 68-pdr smoothbore muzzle-loaders (SMLs) in two twin hand-operated turrets. In February 1864, at the start of the Prusso-Danish War, she was deployed in support of the Danish army. When the Danes were driven from their defensive position near the frontier the army retreated to Dybbøl in south-eastern Jutland, where it was besieged.

When the Prussians built a pontoon bridge between Alnor and Egersund to improve their lines of communication, Captain Rothe commanding the *Rolf Krake* was ordered to sortie from nearby Sønderborg and destroy the bridge. Owing to the shallow water of the Flensburg fjord the *Rolf Krake* was unable to approach her objective. Instead at 9.30am she was drawn into a duel with an emplaced battery of Prussian 12-pounders at Alnor. The fight lasted for 75 minutes, and although the enemy shot bounced off her hull, by the end of the engagement the ironclad's funnel and rigging were shot through, and her deck torn up. Amazingly, only one sailor was seriously wounded. Eventually Rothe withdrew, having failed in his original mission.

The sinking of the Italian ironclad *Re d'Italia* at the battle of Lissa (1866), after being rammed on her port beam by the *Erzherzog Ferdinand Max*. The American-built ironclad was wooden hulled, and lacked watertight compartments. She heeled over and sank within minutes, taking all but 166 of her 565-man crew down with her.

own casemate ironclads, such as the German *König Wilhelm* (commissioned in 1869), the French *Océan* (1870), the Russian *Kniaz Pojarski* (1870), the Austro-Hungarian *Lissa* (1871) and the Italian *Venezia* (1873). So, by the late 1860s broadside ironclads were deemed outdated, and had been eclipsed by this new design.

The naval actions of the American Civil War (1861–65) and at the battle of Lissa (1866) led naval designers to overestimate the tactical importance of the ram. At Lissa the Austro-Hungarian fleet had made good use of ramming tactics to overcome the firepower advantage of their Italian opponents. However, when their broadside ironclads charged at the enemy fleet they were exposed to enemy fire, but were unable to fire back. This encouraged naval designers to consider ways of providing ironclads with some degree of firepower over the bow and stern. The first solution was to make armoured casemates protrude slightly from the side of the ship. Another solution was to cut recesses in the hull fore and aft of the casemate. That allowed the fore or aft guns in the casemate battery to fire through forward- or aft-facing gunports. The Russian *Kniaz Pojarski* is a prime example of this recessed port approach, while the Italian *Venezia* represented the protruding casemate option. Some, like the German Kaiser class, combined elements of both styles.

The next modification in the early 1870s was to mount guns in barbettes, or circular or semi-circular open-topped emplacements, located on the upper deck. As the barbettes usually protruded slightly over the sides of the ship, the same effect of fore-and-aft fire could be achieved. The Austro-Hungarian *Kaiser*, completed in 1873, employed this solution, as did the French Océan class. Although gun barbettes remained in vogue for another decade, they represented a dead end in terms of gun mounting. A much more flexible solution was the gun turret.

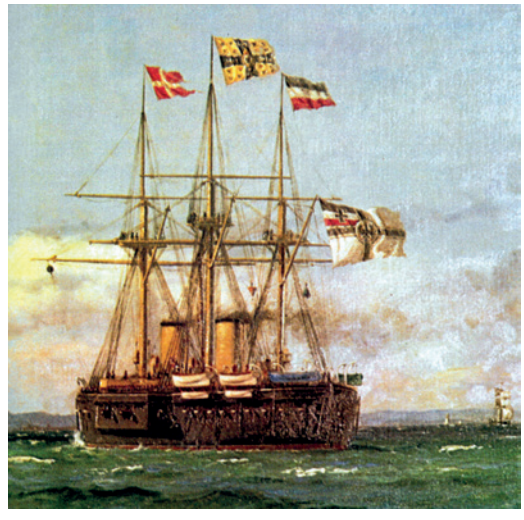
The efficiency of the gun turret was demonstrated in 1862, during the battle of Hampton Roads. The little USS *Monitor* led to other similar warships in the Union fleet, and also in Europe. These, though, like the *Monitor* herself, were coastal defence ships, unsuited to use on the open sea. That said, in 1866 the USS *Miantonomoh* crossed the Atlantic, to 'show the flag' in Europe. An alternative was the small masted turret ship, a vessel with one or two turrets set between masts, and with drop-down panels in her hull, to give the guns a clear arc of fire. Typical of these were the Danish *Rolf Krake* (commissioned in 1863), the German *Arminius* (1865) and the British *Scorpion* (1865). Larger coastal defence vessels produced during this period also tended to be masted turret ships. Examples include the British *Royal Sovereign* (1864), the French *Cerbère* (1868) and the Russian *Admiral Lazarev* (1869).

These, however, were not really designed to fight as part of a battle fleet. Their role was essentially defensive, protecting harbours, estuaries or vulnerable coastlines. Far more important were the larger seagoing

turret ships, which marked the next stage in the development of the ironclad. The first of these was the Italian *Affondatore* (1868), a 4,300-ton armoured ram fitted with two single turrets. Then came the British *Monarch* (1869) and *Captain* (1870), and the Russian *Minin*, laid down in 1866 but only completed in 1878. Like their smaller counterparts, though, these warships were limited by their constricted firing arcs. The solution, of course, was to develop a turret ship where the masts and rigging didn't block the field of fire of the guns.

The result was the mastless turret ship. This represented the final stage of the ironclad's development, or rather the first in the evolution of a new kind of warship – the battleship. The sinking of the British turret ship *Captain* in 1870 made designers throughout Europe leery of turret ships, especially ones which pushed the limits of ironclad design. However, a few coastal defence ships were built, which became the first of this new mastless breed. These included the British *Cerberus* (1870) and *Glatton* (1872) and the bizarre Russian *Novgorod* (1873), a circular coastal defence ship.

While other European powers were slow to embrace the advantages of the mastless turret ship, Britain and Russia led the way by developing seagoing versions of this new type of ship. The result was the revolutionary British mastless turret ship *Devastation* (1873), the world's first modern battleship. The Russians then built the *Petr Veliki*, laid down in 1869 but only completed in 1876. Effectively these ships marked the end of the ironclad era in Europe. Although more conventional ironclads would still be built, by 1875 it was clear that these mastless turret ships represented the future of naval warfare, as their powerful guns and all-round fire proved far more effective than the firepower of the broadside and casemate ironclads that preceded them. So, the era of the ironclad came to an end, and the age of the battleship was born.



The two German casemate ironclads of the Kaiser class were built on the Thames, and entered service in 1875. The *Kaiser*, shown here during a visit to Copenhagen, was later converted into a cruiser, and despite being renamed in 1905 she remained in service until after World War I.

EUROPE'S IRONCLAD FLEETS

Austria-Hungary

In late 1860 the Austrians began designing their own ironclads. The result was the *Drache* and *Salamander*, which were similar to the Italian Formidabile class. Built in Trieste, these Drache-class wooden-hulled broadside ironclads joined the Austrian fleet during 1862, by which time a group of three similar but larger broadside ironclads was under construction. These ironclads, the *Kaiser Max*, *Prinz Eugen* and *Juan d'Austria*, were similar to the Italian Principe di Carignano class. This was no coincidence. In order to maintain the naval balance Austria decided to match whatever ironclads the Italians produced. In the spring of 1863 the Austrian Director

The Austro-Hungarian broadside ironclad *Erzherzog Ferdinand Max* entered service shortly before the battle of Lissa (1866), where she served as the flagship of Rear-Admiral Tegetthoff. Although this photograph of her was taken in the 1880s, her appearance changed very little during her two decades of active service.

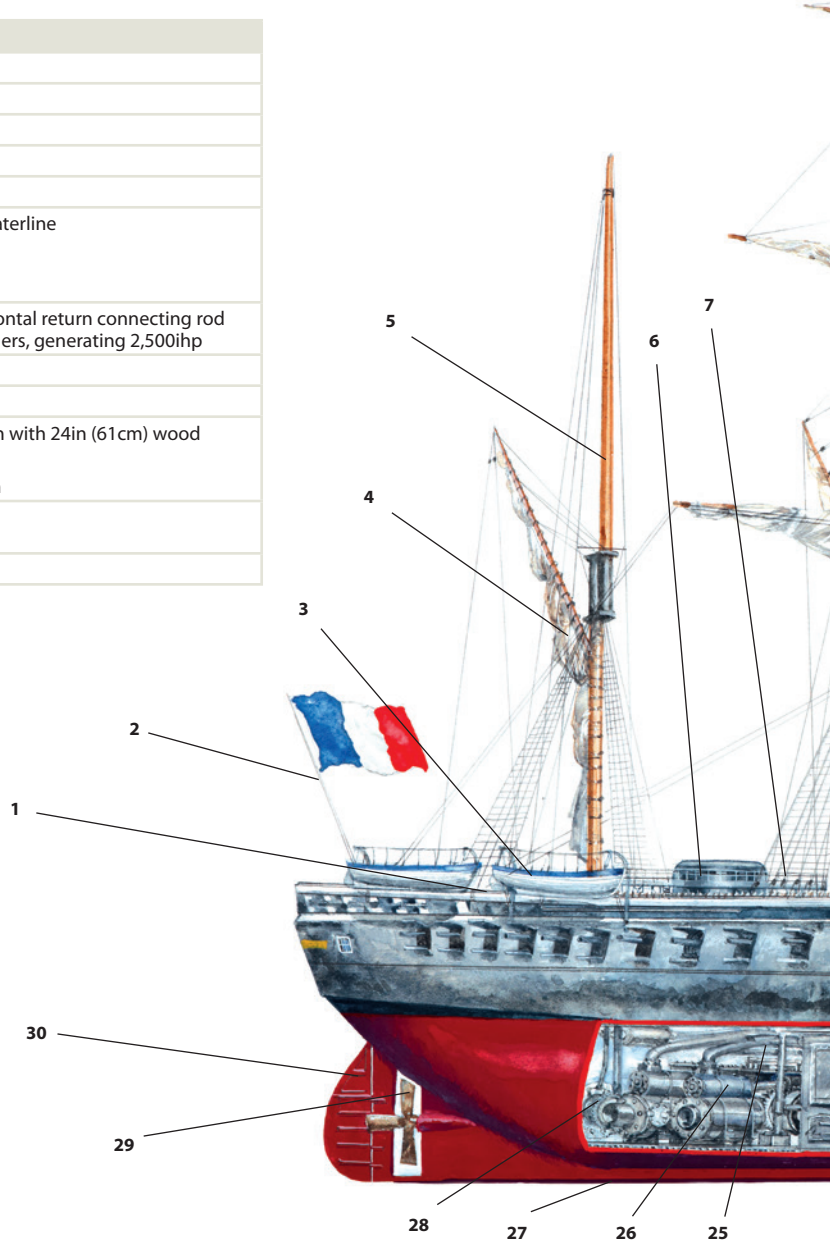
B

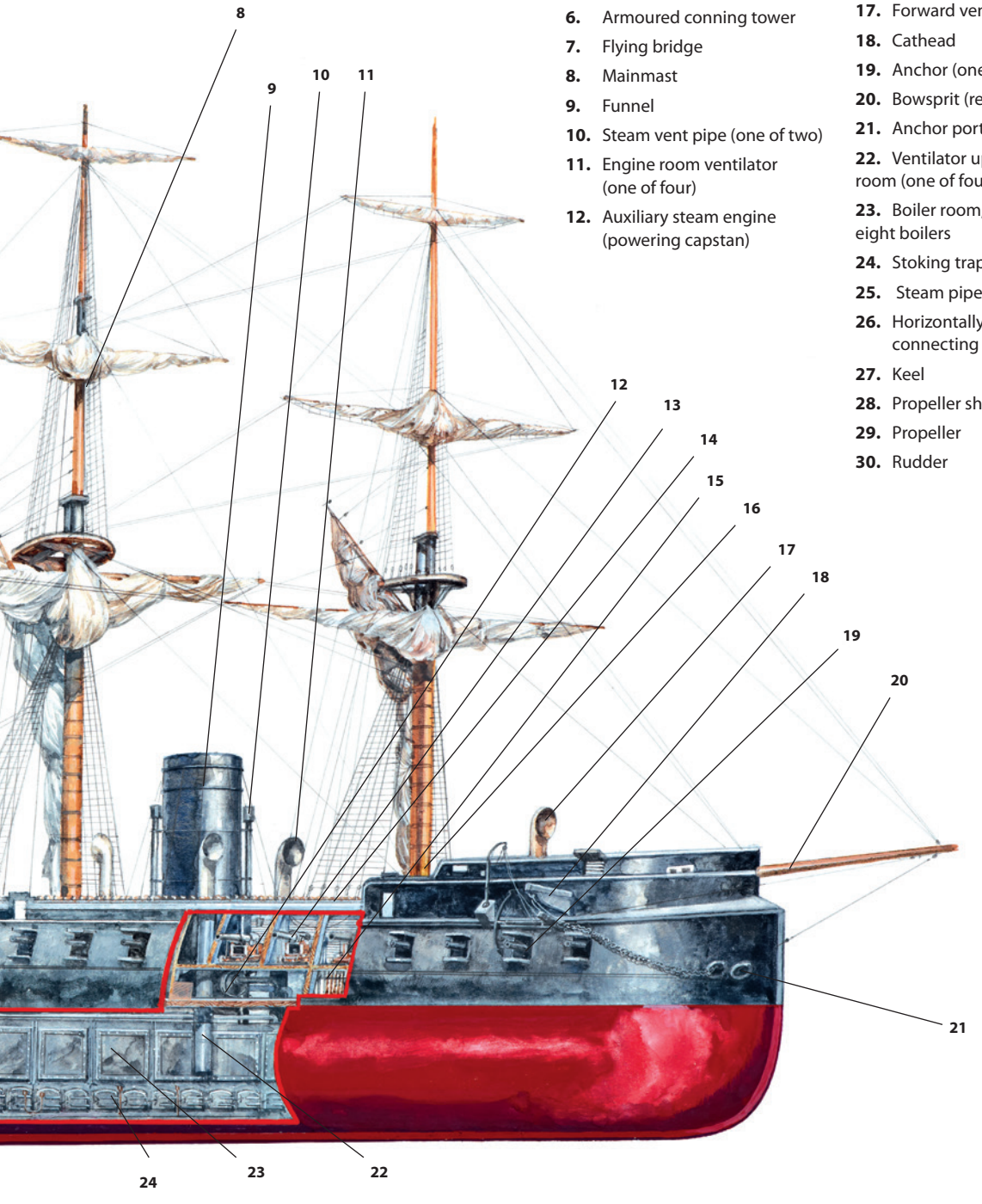
FRENCH IRONCLAD *GLOIRE* (1860)

The *Gloire* (meaning 'Glory') never fired her guns in anger, but she earned her place in history as the world's first seagoing ironclad. When she entered service in August 1860 she was the most powerful warship in the world, a mantle she retained for just 14 months, until the commissioning of HMS *Warrior*. Critics described her as 'ugly', and she was not particularly well designed, but nevertheless she represented a major development in naval warfare.

Essentially *Gloire* was a wooden-hulled frigate, built along traditional lines. What transformed her, though, was the belt of wrought-iron plate bolted to the outside of her hull. She proved cumbersome, leaky and underpowered, she rolled badly, and she was unsuited to deep-water sailing. Her battery was too close to the waterline to permit its use in rough weather, and even then, until it was upgraded, her guns lacked the power needed to penetrate the sides of another ironclad. Nevertheless, her appearance undermined British naval supremacy, and forced the British Admiralty to develop their own seagoing ironclad to counter her. Her original armament of rifled muzzle-loaders (RMLs) was soon replaced by more powerful 9.4in rifled breech-loaders (RBLs), which could at least hold their own against *Gloire's* British counterpart. She remained in service until 1879, when she was stricken from the list, and was finally broken up four years later.

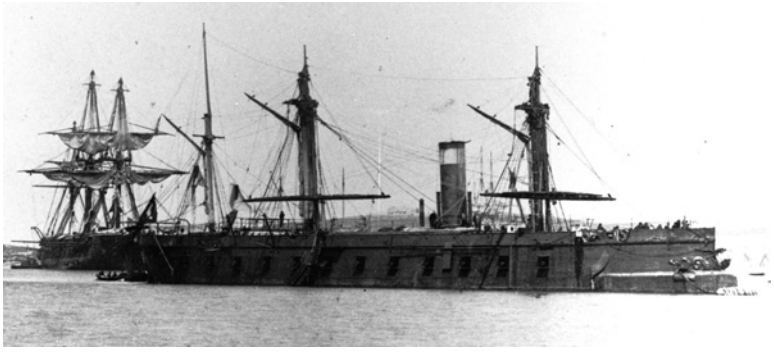
***Gloire* – Gloire-class broadside ironclad**	
Builder	Arsenal de Toulon
Displacement	5,630 tons
Laid Down	4 March 1858
Launched	24 November 1859
Completed	14 August 1860
Dimensions	Length: 255ft 6in (77.88m) on waterline Beam: 55ft 9in (16.99m) Draught: 27ft 10in (8.48m)
Propulsion	Single shaft, powered by a horizontal return connecting rod steam engine and eight oval boilers, generating 2,500ihp
Maximum Speed	12.5–13kts
Coal Bunkerage	665 tons
Armour	Belt: 4.3in–4.7in (10.9–12cm) iron with 24in (61cm) wood backing Conning tower: 4in (10.2cm) iron
Armament (as completed)	36 6.4in Model 1858 RMLs
Complement	570





KEY

1. Quarterdeck
2. Flagstaff (detachable)
3. Ships' gig (forward) and cutter (one pair on each beam)
4. Spanker (furled)
5. Mizzen mast
6. Armoured conning tower
7. Flying bridge
8. Mainmast
9. Funnel
10. Steam vent pipe (one of two)
11. Engine room ventilator (one of four)
12. Auxiliary steam engine (powering capstan)
13. 6.4in Model 1858 Rifled Muzzle Loader (RML) – 18 on each beam
14. Capstan (repeated below deck)
15. Small arms store
16. Foremast
17. Forward ventilator
18. Cathead
19. Anchor (one of two)
20. Bowsprit (retractable)
21. Anchor ports (two per beam)
22. Ventilator uptake from boiler room (one of four)
23. Boiler room, with eight boilers
24. Stoking trap for boiler
25. Steam pipe to engine room
26. Horizontally-mounted return connecting rod steam engine
27. Keel
28. Propeller shaft tunnel
29. Propeller
30. Rudder



The *Drache* and her sister ship *Salamander* were the first ironclads built for the Austro-Hungarian navy, ordered in response to similar small ironclads being purchased by the Italian navy. Both fought at Lissa (1866), where *Drache*'s guns destroyed the Italian ironclad *Palestro*. She is pictured here after her post-Lissa refit. *Drache* remained in active service until 1883.

of Naval Construction, Joseph von Remako, developed plans for two slightly larger wooden-hulled broadside ironclads. Work on the *Erzherzog Ferdinand Max* and *Hapsburg* began that summer, and two years later they were launched in Trieste. Both joined the fleet just before Lissa.

On 20 July 1866, all seven of these Austro-Hungarian broadside ironclads fought at Lissa. So too did ten Italian ones – all those described above, save the two small Terribile-class ironclads, which took no active part in the battle. After the war the Austro-Hungarians continued their shipbuilding programme despite chronic budget constraints. The first of these new builds was the *Lissa*, Austria-Hungary's first casemate ironclad, which was laid down in the summer of 1867. Completion was delayed due to funding, and even when she was commissioned in 1871, she was immediately placed in reserve, to save money.

Drache-class broadside ironclads | 2 in class

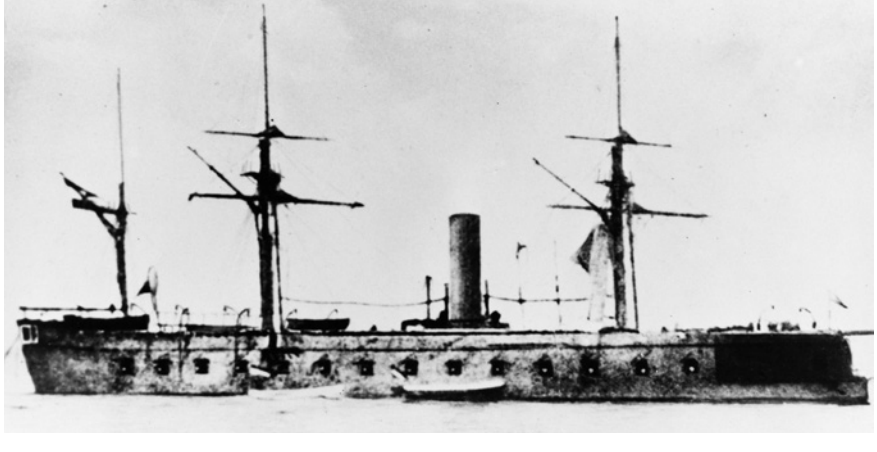
Ship	Built	Laid Down	Launched	Completed	Fate
Drache	Trieste	February 1861	September 1861	November 1862	Decommissioned 1883
Salamander	Trieste	February 1861	August 1861	May 1862	Decommissioned 1895

2,750 tons | Speed: 11kts | Length: 206ft (62.8m) between hull perpendiculars (pp) | Armour: 4.5in (11.4cm) | Guns: 18x6in RMLs, 10x7in SMLs

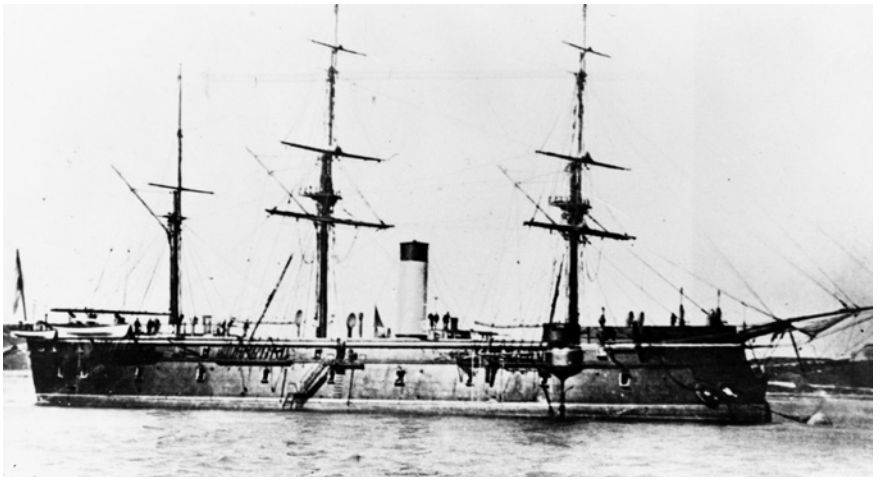
Kaiser Max-class broadside ironclads | 3 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Kaiser Max	Trieste	October 1861	March 1862	1863	Decommissioned 1904
Prinz Eugen	Trieste	October 1861	June 1862	March 1863	Decommissioned 1904
Juan d'Austria	Trieste	October 1861	July 1862	Summer 1863	Decommissioned 1886

3,588 tons | Speed: 11kts | Length: 232ft 2in (70.8m) pp | Armour: 4.5in (11.4cm) | Guns: 15x6in RMLs, 1x4.7in RMLs, 16x7in SMLs



The Austro-Hungarian casemate ironclad *Prinz Eugen* was one of three Kaiser Max-class warships to take part in the battle of Lissa (1866), although unlike her sister the *Kaiser Max* she achieved little. The *Prinz Eugen* was extensively rebuilt in 1873–76, when she was converted into a considerable more powerful casemate ironclad.



The Austro-Hungarian casemate ironclad *Hapsburg* was the sister ship of the *Erzherzog Ferdinand Max*, Tegetthoff's flagship at the battle of Lissa (1866), and the two ironclads steamed into action together. *Hapsburg* is pictured here after emerging from a refit in 1874–75.

Erzherzog Ferdinand Max-class broadside ironclads | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Erzherzog Ferdinand Max	Trieste	May 1863	May 1865	July 1866	Decommissioned 1886
Hapsburg	Trieste	June 1863	June 1865	July 1866	Decommissioned 1898
5,130 tons | Speed: 12.5kts | Length: 274ft 9in (80m) | Armour: 4.8in (12.2cm) | Guns: 16x7in RMLs					

Lissa-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Lissa	Trieste	June 1867	February 1869	May 1871	Decommissioned 1892
7,086 tons | Speed: 12.5kts | Length: 293ft 3in (89.4m) | Armour: 5–6in (12.7–15.2cm) | Guns: 12x9in RBLs					

Meanwhile von Remako designed two more one-off ships, the first iron-hulled ironclads in the fleet. The *Custoza*, so named due to an official misspelling of Austria's land victory of 1866, incorporated the lessons learned at Lissa. For Remako this meant better all-round fire, the addition of a ram, and better armour. *Custoza* was a casemate ironclad, with a 9in (23cm) belt, and a cut-away in her hull forward of the casemate, to allow two guns on each beam to fire ahead. Like the *Lissa* she was destined to be placed in reserve when she joined the fleet in 1875, a fate she shared with the smaller *Erzherzog Albrecht*, which carried slightly lighter guns and marginally less armour, but otherwise resembled her larger half-sister.

Custoza-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Custoza	Trieste	November 1869	August 1872	February 1875	Decommissioned 1920
7,609 tons | Speed: 13.5kts | Length: 311ft 9in (95m) | Armour: 6–9in (15.2–23cm) | Guns: 8x10.2in RBLs, 6x3.5in RBLs					

Erzherzog Albrecht-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Erzherzog Albrecht	Trieste	June 1870	April 1872	June 1874	Decommissioned 1908
5,980 tons | Speed: 12.5kts | Length: 294ft 3in (90m) | Armour: 7–8in (17.8–20.3cm) | Guns: 8x9.4in RBLs, 6x3.5in RBLs					

During the battle of Lissa (1866) the Austro-Hungarian wooden-hulled ship-of-the-line *Kaiser* rammed the Italian ironclad *Re di Portogallo*, sister ship of the *Re d'Italia*. The ironclad suffered little damage, while the unarmoured Austrian ship lost her bowsprit and foremast. Here the two ships fire at each other at point-blank range, as they pull away from each other. Both vessels survived the encounter.

These same budgetary constraints also forced the Austrians to improvise. In 1869 work began on the conversion of the wooden-hulled ship-of-the-line *Kaiser* into a casemate ironclad. Her hull was cut down and rebuilt using iron, but she kept her old propulsion system. The result was an ironclad which resembled the *Lissa*, armed with ten 9in (23cm) RMLs mounted in her two-tiered armoured casemate, protected by 6in (15.2cm) of armour. She rejoined the fleet in late 1873, shortly afterwards the three Kaiser Max-class ironclads were modernized, and converted into central battery ironclads. They now had iron upperworks, and an 8in (20.3cm) belt protecting a casemate, with recesses for one forward-facing gun on each beam. These rejoined the fleet in 1876–78. By then, though, the emergence of mastless turret ships had rendered the Austro-Hungarian fleet obsolescent. The Austro-Hungarians had been slow to respond to developments, and so their fleet became increasingly left behind as other more committed powers entered the battleship era.

Kaiser-class casemate ironclad | 1 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Kaiser	Pola	March 1855 (Conversion began February 1869)	June 1871	December 1873	Decommissioned 1897

5,720 tons | Speed: 11.5kts | Length: 255ft (77.8m) | Armour: 5–6in (12.7–15.2cm) | Guns: 10x9in RMLs

In 1869 work began on converting the Austro-Hungarian ship-of-the-line *Kaiser* into an ironclad. She was reduced in height, and her hull above the waterline was rebuilt using iron. In 1873 she rejoined the fleet as the powerful casemate ironclad pictured here, armed with 9in RMLs.

Denmark

In 1860 the Danish navy consisted of one steam-powered ship-of-the-line, two steam frigates, two steam corvettes and several sailing warships. However, a border dispute with the German Confederation over Schleswig-Holstein threatened to erupt into a full-scale war. So, in 1862 the Danes began modernizing their fleet, converting a sailing ship-of-the-line, *Dannebrog*, and a half-built steam frigate into ironclad frigates, and acquiring a small turret ship from a Scottish shipyard. As a result, when the German-Danish War (or Second Schleswig War) erupted in 1864, the Danish fleet actually had sufficient strength to blockade the Prussian coast. In the battle of Helgoland in May, a small Danish squadron of wooden-hulled steam frigates bested a similar Austro-Prussian squadron. The war on land, though, was another matter, and the Danes were comprehensively defeated. Afterwards, they began expanding their ironclad fleet.

The *Dannebrog*, named after the national flag, was a 74-gun wooden-hulled sailing ship-of-the-line, first commissioned in 1856. In May 1862 she was cut down to her main gun deck, and a Danish-built engine fitted in her hold. Her wooden sides were armoured with 4.5in (11.4cm) of wrought-iron plate, and she was now armed with 16 Danish 6in (15.2cm) 60-pdr RMLs. The work was completed in March 1864, but she played no significant part in the conflict that year, which lasted from February until October. Her guns were then replaced by more powerful mixture of 12 8in (20.3cm) and four 6in (15.2cm) RMLs, but she only remained in active service until 1875.

Similarly the *Peder Skram* was a wooden-hulled steam frigate, laid down in Copenhagen in 1859, and converted into an ironclad similar to the *Dannebrog*. She was completed in 1866, well after the end of the war, and she remained in the fleet until 1885. Like the *Dannebrog* she was a broadside ironclad, armed with 14 RMLs.

Small broadside ironclads | 2 ships

Ship	Built	Laid Down	Launched	Completed	Fate
Dannebrog	Copenhagen	April 1848 (Conversion begun 1862)	Originally in September 1850	March 1864	Decommissioned 1897
Peder Skram	Copenhagen	May 1859 (Conversion begun 1862)	October 1964	August 1866	Decommissioned 1897

3,057–3,330 tons | Speed: 9–11.5kts | Length: 185ft 4in–228ft (56.5–67.3m) pp | Armour: 4.5in (11.4cm) RMLs | Guns: 12x8in RMLs, 16x6in RMLs (*Dannebrog*), 6x8in RMLs, 12x6in RMLs (*Peder Skram*)

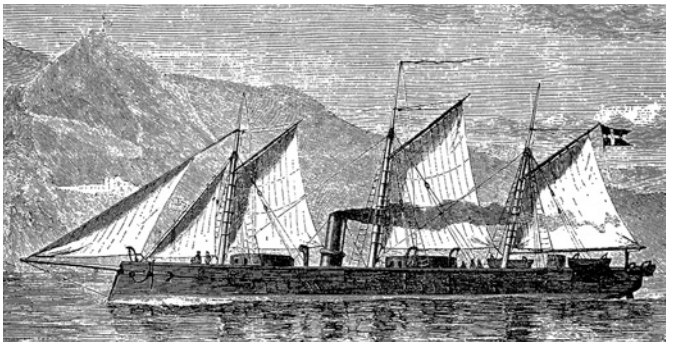
A more novel vessel was the *Danmark*, a broadside ironclad based on the *Gloire*, which was built for the Confederacy in Clydebank, and laid down in 1862. She proved too costly for the Confederate navy, and so she was bought by Denmark in 1864. However, she only joined the fleet four years later. She proved an ungainly, uncomfortable ship, and was soon placed in reserve.

Broadside ironclad | 1 ship

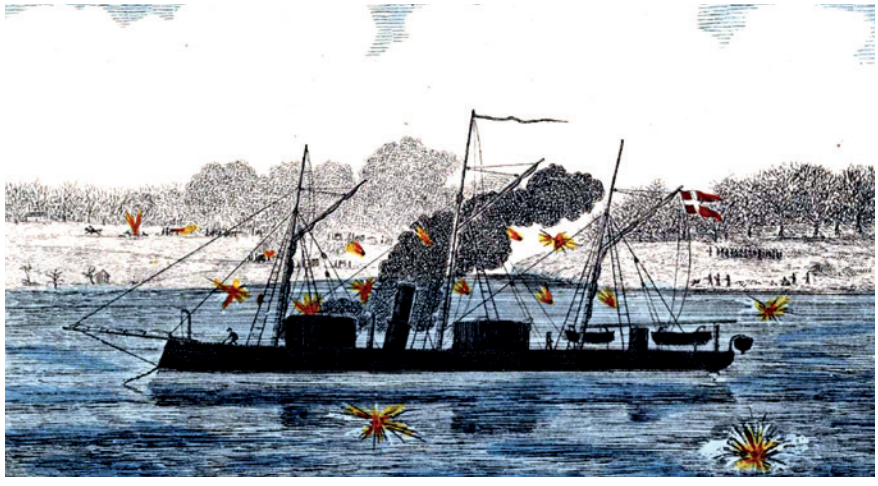
Ship	Built	Laid Down	Launched	Completed	Fate
Danmark	Clydebank	September 1862	February 1864	April 1869	Decommissioned 1900

4,670 tons | Speed: 8.5kts | Length: 270ft (82.3m) pp | Armour: 4.5in (11.4cm) | Guns: 12x8in, 12x6in RMLs

Altogether more successful was the small flotilla of coastal defence turret ships built during the 1860s. The most famous of these was the *Rolf Krake*, a small three-masted turret ship built in the Robert Napier shipyard on Clydebank. Her hull and turrets were protected by 4.5in (11.4cm) of wrought iron, and her two turrets, designed by Cowper Coles, each carried two Swedish-built 6.4in (16.3cm) 68-pdr smoothbores. She was commissioned in July 1863, and so was on hand to play a notable role in the German-Danish War. After the conflict the Danes abandoned the building of large seagoing warships,



The small Danish turret ironclad *Rolf Krake* was designed by Cowper Coles, the British designer of the ill-fated HMS *Captain*. Her two turrets were hand-operated, and each was armed with a pair of Swedish 68-pdr smoothbore muzzle-loaders, capable of firing both solid shot and explosive shell.



The Danish turret ship *Rolf Krake* in action against Prussian gun batteries off Alnor on the Flensburg fjord in February 1864. In this duel the small Danish ironclad was hit repeatedly, but while her masts, funnel and rigging were badly damaged, none of the Prussian shot or shell penetrated her iron hull.

as the Danish fleet became a purely defensive force. They did build three coastal defence ironclads before 1875: two monitors (the *Lindormen* and *Gorm*), and the *Odin*, which was a small casemate ironclad equipped with four 10in (25cm) RMLs and a retractable ram. But defeat in 1864 marked the end of Denmark's wholehearted participation in the ironclad revolution.

Small turret ship | 1 ship					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Rolf Krake	Clydebank	October 1862	May 1863	July 1863	Decommissioned 1907
3,382 tons | Speed: 9.5kts | Length: 183ft 9in (56m) pp | Armour: 4.5in (11.4cm) | Guns: 4x6.4in SMLs					

France

In France, Dupuy de Lôme faced two big challenges. The first was the limitations of French iron production, which meant that France lacked the ability to build a fleet of iron-hulled ships. De Lôme therefore opted for wooden-hulled warships clad in iron, and in March 1858 the funds were released for the building of six broadside ironclads of this design. The first of these was *Gloire*, and two more of her class, the *Invincible* and *Normandie*, were approved in May and September. Unfortunately, de Lôme's second challenge was a dearth of seasoned timber. This meant that *Invincible* and *Normandie* were built using green timber. As a result they barely lasted a decade before their hulls became rotten and were condemned.

During this period French naval guns were forged from cast iron, reinforced by one or more layers of steel wire hoops. From 1870 these were further reinforced by an outer steel tube, as seen on this 10.8in (27.4cm) breech-loading piece, mounted in a casemate ironclad of the 1870s.

Dupuy de Lôme, though, had his ultimate wish, and the fourth vessel, which became the *Couronne* (Crown), was to be an iron-hulled version of the *Gloire* albeit one armed with breech-loading guns. She was designed by Camille Audinet, who altered the *Gloire* plans to suit this all-iron construction. While the *Couronne* was iron hulled, as was the Provence-class ironclad *Héroïne*, all other French ironclads of this period were wooden-hulled vessels, clad in wrought iron. Of the five ironclads ordered at the same time as *Gloire*, *Invincible* and

Normandie were identical to her, except for their unseasoned timber. The *Couronne* was delayed due to her challenging all-iron construction and her armour, which consisted of a composite layer of wood and iron latticework bolted to her iron hull, and which actually proved superior to the armour of her wooden-hulled contemporaries.

Gloire-class broadside ironclads | 3 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Gloire	Toulon	March 1858	November 1859	August 1860	Decommissioned 1879
Invincible	Toulon	May 1858	April 1861	March 1862	Decommissioned 1872
Normandie	Cherbourg	September 1858	March 1860	May 1862	Decommissioned 1871
5,630 tons | Speed: 12.5–13kts | Length: 255ft 6in (77.9m) | Armour: 4.3–4.7in (10.9–12cm) | Guns: 36x 6.4in RMLs					

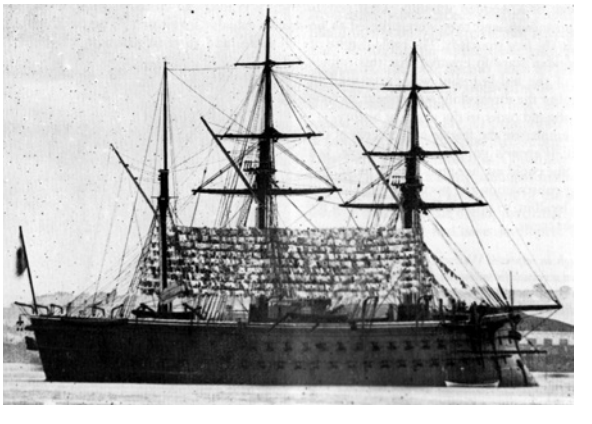
Couronne-class broadside ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Couronne	Lorient	February 1859	March 1861	February 1862	Decommissioned 1910
5.983 tons | Speed: 13kts | Length: 262ft 5in (80m) | Armour: 3.2–4in (8.1–10.2cm) | Guns: 30x6.4in RBLs, 10x8.9in SMLs					

Two more ironclad warships had been ordered at the same time. Rather than armoured frigates, these were full-sized ironclad ships-of-the-line. Plans for them were finalized by de Lôme in early 1859, and work on the *Magenta* and *Solferino* began that June. Both were launched two years later. These imposing wooden-hulled broadside ironclads carried 50 guns in two gun decks. So, they were effectively ironclad versions of the ship-of-the-line. Their ordnance was upgraded twice during the 1860s, so they maintained their key role in the French fleet well into the next decade. *Magenta*, though, was destroyed in 1875 when she blew up at her moorings.

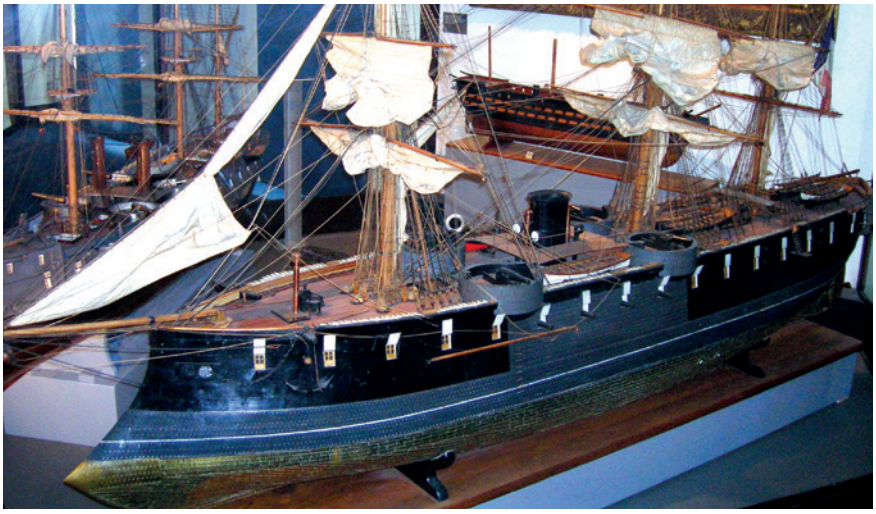
Magenta-class broadside ironclads | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Magenta	Brest	June 1859	June 1861	January 1862	Sunk by accidental explosion, October 1875
Solferino	Lorient	June 1859	June 1861	August 1862	Decommissioned 1882
6,715 tons | Speed: 13kts | Length: 282ft 1in (86m) | Armour: 4.3–4.7in (10.9–12cm) | Guns: 16x7.6in SMLs, 34x6.4in RBLs, 2x8.9in RMLs					

While the British ironclad *Warrior* had its own steam-powered laundry, the French ironclads relied on more traditional methods. Here the rigging of the *Magenta*, flagship of the French Mediterranean Fleet based in Toulon, is festooned with the laundry of her 750-man crew.

In November 1860 the government approved the building of ten more improved versions of the *Gloire*. They became the Provence class, and were laid down in 1861. Their gun deck was higher than the *Gloire*'s, and a more powerful armament was fitted, although this varied from ship to ship. By 1868, however, this had standardized somewhat, and consisted of 7.6in (19.3cm) and 9.4in (24cm) guns. This meant that, at least at close range, they could probably penetrate the hull armour of the latest generation of British ironclads.



This model of the French casemate ironclad *Océan* from the collection of the Musée National de la Marine clearly shows the unusual deck layout of the three ships in this class, dominated by four barbettes, each housing a large muzzle-loading 9.4in RML.



Provence-class broadside ironclads | 10 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Flandre	Cherbourg	January 1861	June 1864	May 1865	Decommissioned 1886
Gauloise	Brest	January 1861	April 1865	April 1867	Decommissioned 1883
Surveillante	Lorient	January 1861	August 1864	October 1867	Decommissioned 1890
Magnanime	Brest	February 1861	August 1864	November 1865	Decommissioned 1882
Guyenne	Rochefort	March 1861	September 1865	April 1866	Decommissioned 1882
Provence	Toulon	March 1861	October 1863	February 1865	Decommissioned 1884
Revanche	Toulon	March 1861	December 1865	May 1867	Decommissioned 1893
Savoie	Toulon	March 1861	September 1863	March 1865	Decommissioned 1888
Valeureuse	Brest	May 1861	August 1864	February 1867	Decommissioned 1886
Héroïne	Lorient	June 1861	December 1863	July 1865	Decommissioned 1894

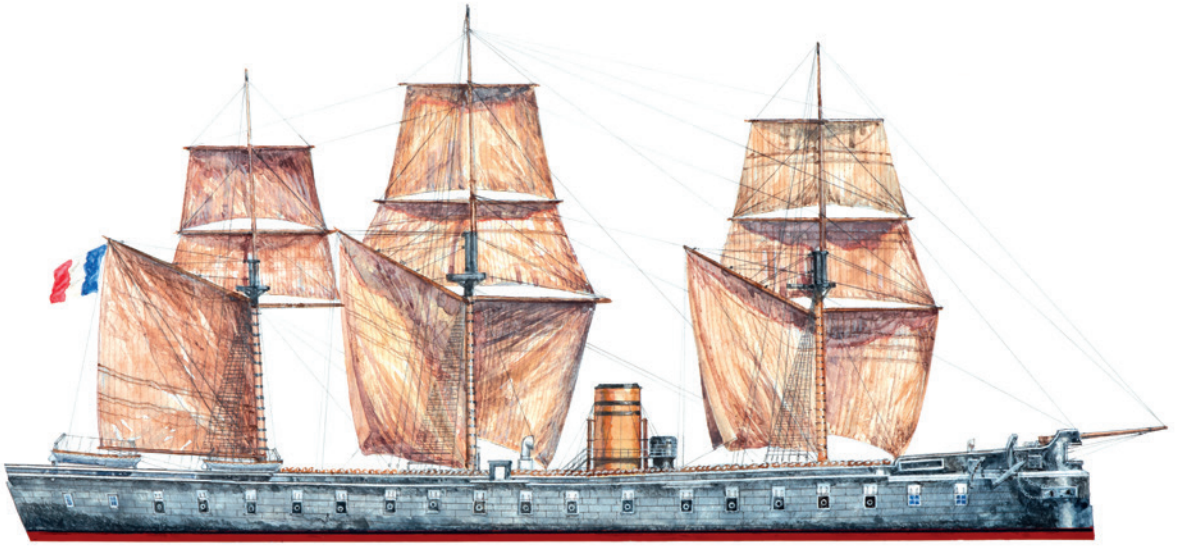
5,700–6,122 tons | Speed: 13–14kts | Length: 262ft 5in (80m) | Armour: 4.3–6in (10.9–15.2cm) | Guns: 4x9.4in RMLs, 10x7.6in SMLs (*Flandre*, *Héroïne*, *Provence*: 10x7.6in SMLs, 22x6.4in RBLs, 2x 8.9in RMLs)

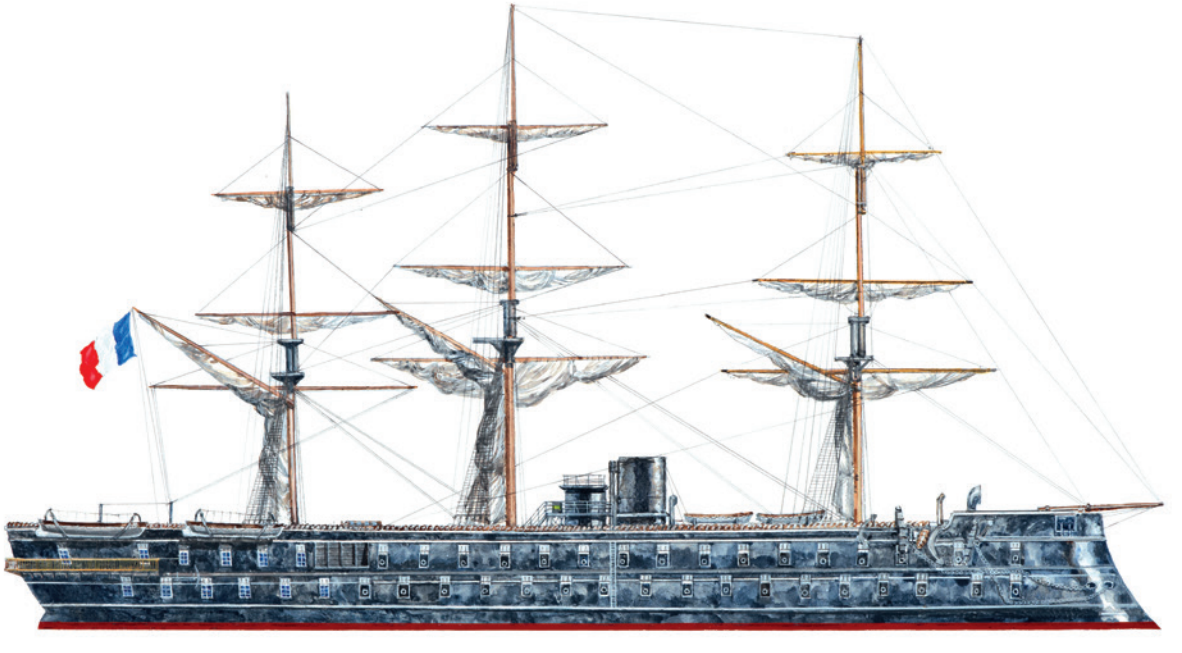
C

FRENCH IRONCLADS *PROVENCE* (1865) AND *SOLFERINO* (1862)

The Provence class of broadside ironclads was essentially designed as an improved version of the *Gloire*. Although they were a little longer, with a slightly greater displacement and draught, the main improvement was a thicker armoured belt of 6in (15.2cm) at the waterline, to protect these ships' vitals. However, this was reduced to 4.3in (10.9cm) around the gun deck. The guns themselves were mounted a little higher than in the Gloire class, and instead of a composite battery of 6.4in RMLs, these ships carried the more effective Model 1864 RBLs, soon augmented by larger 7.6in (19.3cm) and 9.4in (24cm) pieces. The *Provence* shown here (top) was one of ten ships of her class, and spent most of her career serving with the French Mediterranean Fleet.

Even while the *Gloire* was under construction, her designer Dupuy de Lóme was drawing up plans for an even larger ironclad class, mounting its guns on two decks. Effectively, while *Gloire* was an armoured frigate, this would be an armoured ship-of-the-line. The result was the Magenta class of two broadside ironclads. He also intended them to carry a large armoured ram, and so the hull was specially strengthened to accommodate this. This, together with their size, gave the two large ironclads *Magenta* and *Solferino* a lumbering and ungainly appearance. Although they were protected with a similar armoured belt to *Gloire*, this did not extend beyond the main battery, leaving the bow and stern unprotected. Still, with an imposing armament of 50 guns, these were extremely powerful warships, and the largest ironclads of their day. While *Magenta* was based in Toulon, *Solferino* (bottom) spent much of her career with the French Atlantic Coast Fleet, based in Brest.





A much more unusual vessel was the *Rochambeau*. She was built in New York during the American Civil War (1861–65), and was earmarked to become the USS *Dunderberg*. However, she was still incomplete when the war ended, and in 1867 the US government sold her to France. In theory she was a broadside ironclad, based on the CSS *Virginia*, and had a similar sloping casemate to that of the Confederate vessel. She entered the French navy in August 1867, but she was deemed a poorly designed vessel and was soon placed in reserve, and was decommissioned five years later.

Rochambeau-class casemate ironclad | 1 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Rochambeau (ex-*Dunderberg*)	New York	October 1862	July 1865	August 1867	Decommissioned 1872

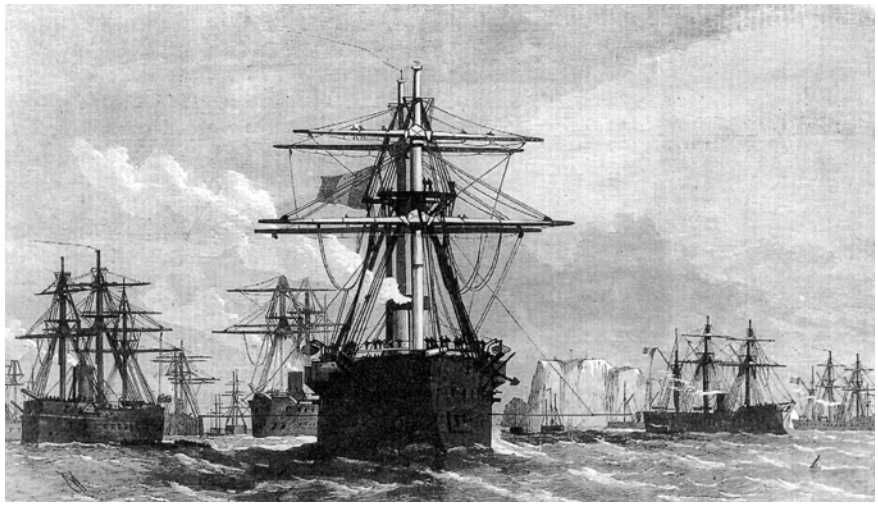
7,849 tons | Speed: 14.5kts | Length: 352ft 4in (107.4m) pp | Armour: 7.1–4.7in (7.1–12cm) | Guns: 4x10.8in RMLs, 10x9.4in RMLs

The Océan class comprised the first central battery casemate ironclads built for the French navy. Designed by Dupuy de Lôme, they were wooden hulled, but their casemate was protected by up to 8in (20.3cm) of armour, backed by teak. These ironclads had transverse iron bulkheads, protecting the two ends of the casemate from raking fire, with another bulkhead amidships which divided the gun deck in two. Interestingly, while most of the guns were mounted in this main gun deck, four pieces were carried on barbette mounts, two on each beam of the upper deck. All of them were ordered in 1865–66, but only *Océan* entered service on schedule in 1870. *Marengo* took nearly seven years to build, and *Suffren* nearly ten.

Océan-class casemate ironclads | 3 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Océan	Brest	July 1865	October 1868	July 1870	Decommissioned 1894
Marengo	Toulon	July 1865	December 1869	April 1872	Decommissioned 1896
Suffren	Cherbourg	July 1866	December 1870	March 1876	Decommissioned 1895

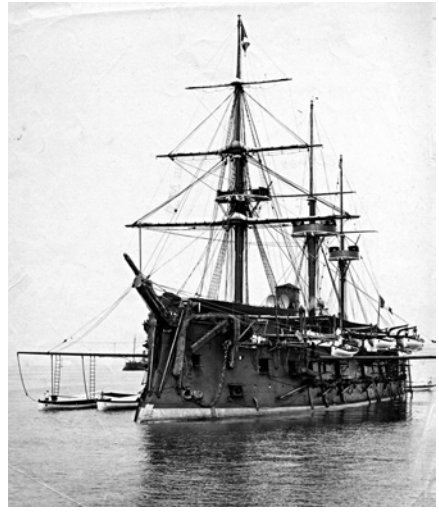
7,580–7,775 tons | Speed: 13–14kts | Length: 287ft 10in (87.7m) | Armour: 6–8in (15.2–20.3cm) | Guns: 4x10.8in RMLs, 6x5.5in RMLs, 4x9.4in RBLs



The French fleet, depicted off the island of Helgoland, which they used as a base for the blockade of Wilhelmshaven and Hamburg. At least six ironclads are shown here, with the brand-new *Océan* in the foreground, flanked by a Provence-class ship (left) and the *Couronne* (right).

By then four more casemate ironclads were being constructed. The first three were wooden-hulled vessels. *Richelieu*, laid down in 1869, was broadly similar to *Océan*, with a central battery, and four more guns in barbettes on the upper deck. A fifth upper-deck gun was mounted as a bow-chaser. Next came the two ships of the Colbert class (*Colbert* and *Trident*), which were broadly similar, but were better armoured and had a far more pronounced tumblehome to the bow.

In addition, the French built a number of coastal defence ironclads, the first of which were little more than improved versions of the floating batteries which saw action in the Crimean War. Then, in 1863, work began on a small armoured ram, the *Taureau*, designed by Dupuy de Lôme and inspired by the Confederate ironclad ram *Manassas*. She carried a single barbette-mounted gun. By the time she entered service in 1866 four larger versions had been ordered, which joined the fleet between 1868 and 1874.



This unusual view of the bows of the Océan-class casemate ironclad *Marengo* clearly shows her prominent ram bow which projected 9ft (2.7m) forward of her bow below the waterline. Unfortunately her upper deck barbettes are obscured by her boats.

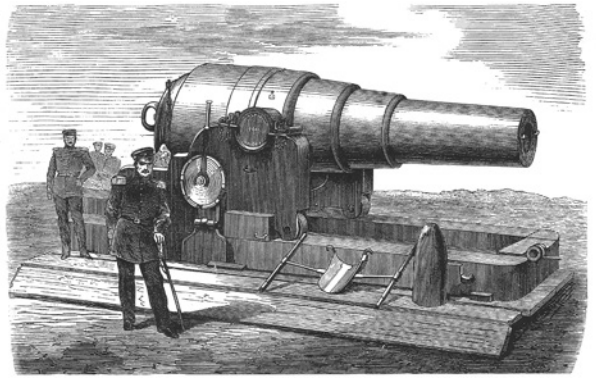
Richelieu-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Richelieu	Toulon	December 1869	December 1873	February 1876	Decommissioned 1900
8,984 tons | Speed: 13kts | Length: 322ft (98.2m) | Armour: 4.5–8.7in (11.4–22cm) | Guns: 6x10.8in RMLs, 5x9.4in RMLs, 10x4.7in RMLs					

The real problem facing the French, though, was the limited capacity of French shipyards. While their first ironclads took roughly four years to build, most of the Provence and Océan classes took between five and ten years to complete. By contrast contemporary British ironclads were usually built within three years. For example, the *Friedland*, an iron-hulled version of the Océan class, was laid down in Lorient in 1865, but was only commissioned in 1876. During this time the British, regaining the technological lead from France, had brought far more powerful mastless turret ships into service. These rendered the new French ironclads obsolete before they even entered service. France lost the ironclad race not through a lack of shipbuilding skill but through a lack of industrial wherewithal and commitment to technological progress.

Friedland-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Friedland	Lorient	July 1865	October 1873	June 1877	Decommissioned 1898
8,850 tons | Speed: 13kts | Length: 317ft 2in (96.7m) | Armour: 6.3–8in (16–20.3cm) | Guns: 8x10.8in RMLs, 8x5.5in RMLs					

Germany

Germany as a political entity didn't exist in 1860. The first German ironclads flew the Prussian naval ensign, and from 1867 they formed part of the Norddeutsche Bundesmarine (North German Federal Navy). On 1 January 1871 the German Empire was formed, and with it the Kaiserliche Marine (Imperial Navy). In the mid-1860s, as Prussia emerged victorious from wars fought against Denmark (1864) and Austria (1866), it was decided that the quickest way to build an ironclad navy was to purchase ships from abroad.



An 8.2in (21cm) Krupp rifled muzzle loader (RML), depicted here before the piece was mounted in the Prussian turret ship *Arminius*, commissioned in 1865. She carried four of these guns in two twin turrets. The same piece was mounted in all Prussian/German ironclads during this period.

The first of these purchases was the *Cheops*, one of two ironclad rams built in Bordeaux for the Confederacy. Her sister ship the *Sphinx* was completed in October 1864, and served in the Confederate navy as the CSS *Stonewall Jackson* until the end of America's Civil War the following spring. She was subsequently sold to Japan, where she was renamed the *Adzuma*.

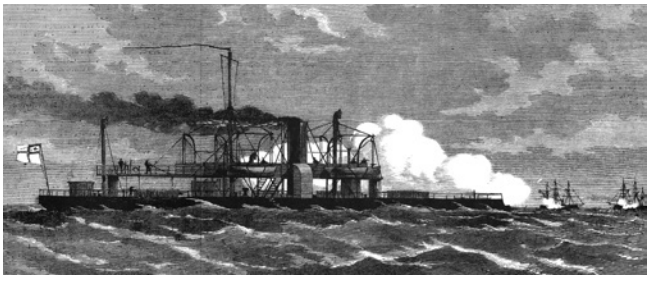
Cheops was still being fitted out in Bordeaux when the Confederacy surrendered. She was purchased by the Prussian navy, and joined the Bundesmarine the following summer, where she became the *Prinz Adalbert*. She was an ironclad ram – little more than a coastal defence ship, displacing just over 1,500 tons – and her wooden hull was protected by a 5in (12.7cm) belt. Between her masts sat a static circular casemate, with two 6.7in (17cm) Krupp RMLs in it, firing from fixed ports, one covering each beam. Another 8.2in (21cm) RML was mounted in the bow. The *Prinz Adalbert* was a fairly ineffective warship, and her unseasoned timbers soon began to rot. However, she represented a vital first step. By the time the *Prinz Adalbert* reached the Baltic another similar ironclad was already commissioned into Prussian service. She was the *Arminius*, a small coastal defence turret ship, displacing 1,800 tons. She was built on the Thames following a design by Captain Cowper Coles, the British gun turret pioneer who also created the ill-fated HMS *Captain*. That said, she was virtually identical to the Danish *Rolf Krake*. The *Arminius* had two twin turrets, fitted with 8.2in (21cm) Krupp RMLs. Her belt was 4.5in (11.4cm) thick, backed by teak. She was a powerful little ship, and a useful addition to the fleet, despite being notoriously difficult to steer. In 1870 her masts were removed, and a flying deck added over the turrets, in an effort to improve her guns' arcs of fire.

Early small ironclads | 2 ships

Ship	Built	Laid Down	Launched	Completed	Fate
Arminius	London	May 1863	August 1864	April 1865	Decommissioned 1901
Prinz Adalbert (ex-*Cheops*)	Bordeaux	July 1863	June 1864 (Purchased January 1865)	June 1866	Decommissioned 1871

1,535–1,800 tons | Speed: 10–11kts | Length: 186ft 8in–207ft 5in (56.9–63.2m) | Armour: 4.5–5in (11.4–12.7cm) | Guns: 1x8.2in RMLs, 2x6.7in RMLs (*Prinz Adalbert*), 4x8.2in RMLs (*Arminius*)

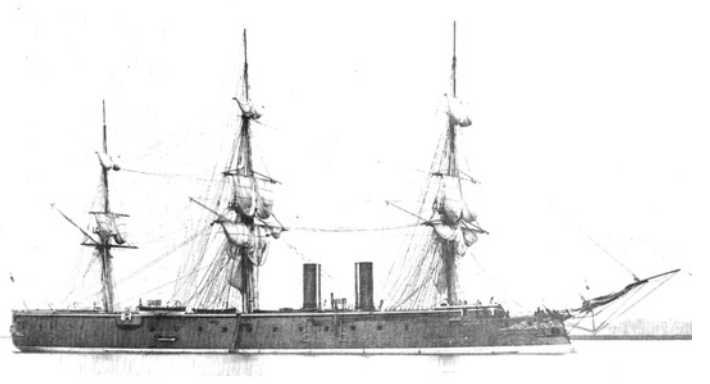
The North German Federation turret ship *Arminius*, pictured in a skirmish with French warships in the Weser estuary near Bremerhaven in August 1869. The engraving incorrectly shows her with her schooner masts removed, and a flying bridge added. In fact, this modification was made during the winter of 1869–70.



These, though, were little more than coastal defence ships. What followed from 1865 was the real birth of the German navy through the construction of three seagoing ironclads, all built in foreign yards. The *Friedrich Carl* was a casemate ironclad of just over 6,800 tons, built in Toulon as an armoured frigate. She was armed with 16 Krupp 8.2in (21cm) RMLs, protected by a 4.5in (11.4cm) belt, backed by teak. She joined the Bundesmarine in October 1867, a month after the *Kronprinz*. *Kronprinz* was a similar casemate ironclad, built in

London from a design produced by Sir Edward Reed. At just under 6,200 tons she was slightly smaller than the *Friedrich Carl*, but still carried a broadside armament of 16 8.2in (21cm) RMLs, and was protected by a belt similar to the *Friedrich Carl*.

Then came the *König Wilhelm*. She was another Reed-designed casemate ironclad, which was originally laid down in London for the Turkish navy. She was purchased by Prussia in February 1867, while still on the stocks. Before joining the Bundesmarine in June 1869 she was equipped with Krupp guns, 18 9.4in (24cm) and five 8.2in (21cm) RMLs. What really set her apart was her armoured belt, which was a full 12in (30.5cm) deep in front of the casemate, tapering to 6in (15.2cm) at either end. Although she displaced over 10,500 tons, her powerful Maudslay engine gave her a similar speed to the *Kronprinz*, which was less than two-thirds of her size. Unsurprisingly, she has been likened to an enlarged and up-gunned HMS *Warrior*.



The German casemate ironclad *König Wilhelm* was designed in Britain by Sir Edward Reed, and was originally intended for service with the Turkish navy. When she entered service shortly before the Franco-Prussian War (1870–71) she became the flagship of the new North German Federal Navy.

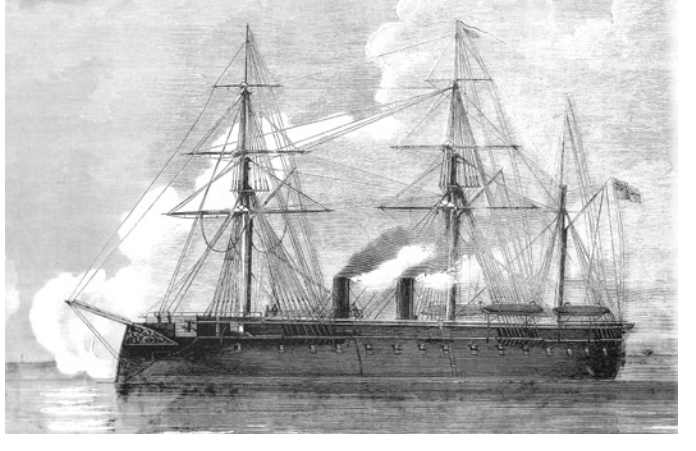
Early casemate ironclads | 3 ships

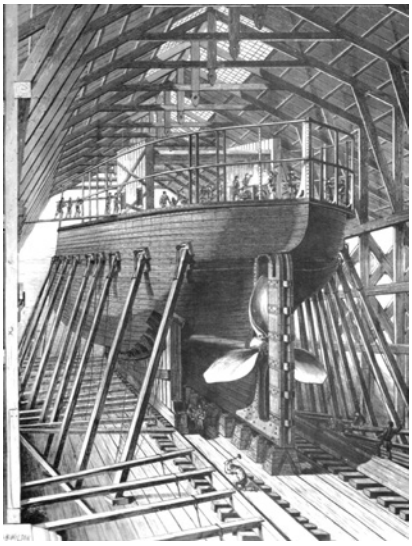
Ship	Built	Laid Down	Launched	Completed	Fate
König Wilhelm (ex-*Fatikh*)	London	1865 (Purchased February 1867)	April 1868	February 1869	Decommissioned 1921
Friedrich Carl	Toulon	Spring 1866	January 1867	October 1867	Decommissioned 1905
Kronprinz	London	Summer 1866	May 1867	September 1867	Decommissioned 1901

6,197–10,591 tons | Speed: 13.5–14.5kts | Length: 293ft 5in–368ft 1in (89.4–112.2m) | Armour: 4.5–5in (11.4–12.7cm) (*König Wilhelm* 6–12in [15.2–30.5cm]) | Guns: 16x8.2in RMLs (*König Wilhelm* 18x9.4in RMLs, 5x8.2in RMLs)

Designed and built in France, the Prussian casemate ironclad *Friedrich Carl* entered service in 1867, before the Franco-Prussian War, and so was one of the small squadron of ironclads charged with the defence of Wilhelmshaven during the war. Although she made sorties, she never saw action against the French.

When the *König Wilhelm* joined the Bundesmarine in February 1869 she became the fleet flagship of Prinz-Admiral Adalbert von Preussen. During the Franco-Prussian War (1870–71) these five ironclads formed the core of the German fleet, and although they largely avoided action, they represented a powerful 'fleet in being'. After the war, and the formation of the Imperial Navy, work continued on Germany's first home-built ironclad, the *Hansa*. This armoured corvette with a composite iron and wood hull was launched in Danzig in late 1872, and completed in May 1875. The 4,334-ton casemate ironclad was built using faulty iron which led to rapid rusting, and she lacked manoeuvrability. Still, she carried eight Krupp 8.2in (21cm) RMLs, lodged behind a 6in (15.2cm) thick casemate.





The small *Hansa*, the first ironclad designed and built in Germany, was constructed in Danzig and fitted out in Stettin. Her single screw seen here was powered by a Vulcan three-cylinder single-expansion engine, generating a top speed of around 12.5 knots.

Hansa-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Hansa	Danzig	Autumn 1868	October 1872	May 1875	Decommissioned 1888
4,334 tons | Speed: 12.5kts | Length: 241ft 1in (73.5m) | Armour: 4.5–6in (11.4–15.2cm) | Guns: 8x8.2in RMLs					

She was the last home-built German ironclad to enter service during this period, although the Grosser Kurfürst (or Preussen) class of three casemate ironclads were laid down in German shipyards, and would be completed between 1876 and 1878. Their design was based on the new Austro-Hungarian ironclad *Custoza*. However, in 1872 the German navy ordered two more ironclads to be built in London, designed by Sir Edward Reed. When built these two Kaiser-class frigates displaced a little under 9,000 tons, and were protected by a belt up to 10in (25.4cm) thick at the waterline, and 8in (20.3cm) over the casemate, with teak backing. This armour thinned slightly at either end. Each carried eight 10.2in (26cm) Krupp RMLs, and two 6.7in (17cm) RML on the upper deck.

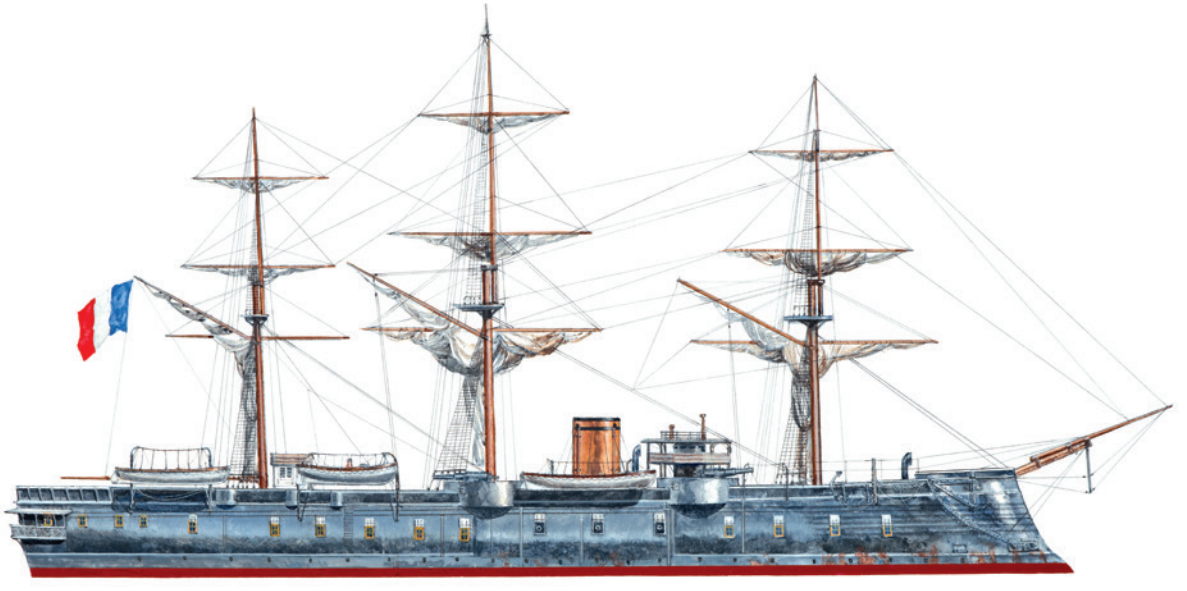
Grosser Kurfürst or Preussen-class turret ships | 3 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Grosser Kurfürst	Wilhelmshaven	1868	September 1875	May 1878	Sunk in collision, May 1878
Friedrich der Grosse	Kiel	1869	September 1874	November 1877	Decommissioned 1906
Preussen	Stettin	1870	November 1873	July 1876	Decommissioned 1906
7,596 tons | Speed: 14kts | Length: 316ft 10in (96.6m) | Armour: 4–9in (10.2–23cm) | Guns: 4x10.2in RMLs, 2x6.7in RMLs					

D

FRENCH IRONCLAD *OCÉAN* (1870) AND GERMAN IRONCLAD *KÖNIG WILHELM* (1869)

The Océan class of three ships represented a new departure for the French, moving on from the broadside ironclad to the casemate ironclad, which permitted the mounting of a smaller battery of more powerful guns, protected by a thicker armoured belt. Like their predecessors these ships were designed by Dupuy de Lôme, but their configuration was changed repeatedly during construction, which delayed their completion. Like all earlier French ironclads *Océan* (top) was wooden hulled, but her armoured belt extended the full length of the ship. She carried a mixed battery of ordnance, with four 9.4-in RBLs mounted in four semi-circular barbettes on the upper deck level, two on each beam. These were powerful ships, the first of France's second generation of ironclads.

The Prussians were late starters to the ironclad revolution. Initially they ordered ships from British or French shipyards, but by 1868 they felt confident enough to build their own. The last of these foreign builds was the *König Wilhelm* (bottom). She was a casemate ironclad, originally built on the Thames for the Turkish navy before being purchased by Prussia. Her main gun deck was conventional enough, but she also carried five smaller 8.3-in RBLs mounted in casemates on her upper deck, which allowed fire ahead or astern. She entered service in what had become the North German Federal Navy in the summer of 1869, and during the Franco-Prussian War (1870-71) she was the most powerful warship in the Bundesmarine, as well as its flagship. However, she was never tested in battle against the French blockading squadrons.



Kaiser-class casemate ironclads | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Kaiser	London	May 1872	March 1874	February 1875	Decommissioned 1906
Deutschland	London	May 1872	September 1874	July 1875	Decommissioned 1906
8,799 tons | Speed: 14.5kts | Length: 293ft 1in (89.3m) | Armour: 5–10in (12.7–25.4cm) | Guns: 8x10.2in RMLs, 1x8.3in RMLs					

The *Kaiser* and *Deutschland* had double bottoms, and nine transverse watertight bulkheads. These entered service in 1875, and proved excellent ships: fast, manoeuvrable and stable. Not only were they the last foreign-built ships to join the Imperial Navy; they were also the last of their kind. From 1875 on, the pace of naval construction slowed for a decade. However, the period 1875–85 saw the building of the Sachsen class, modern mastless iron-hulled battleships, armed with guns mounted in barbettes. At that time the Imperial Navy had few aspirations, and was a purely defensive fleet, its power divided between the North and Baltic seas. This would change dramatically in the decades to come.

Italy

In 1860, before *Gloire* was even finished, the Sardinians ordered two smaller versions of her from a French shipyard outside Toulon. The *Formidabile* and *Terribile* were wooden-hulled with a 4.3in (10.9cm) protective belt, and a broadside of 20 RMLs. By the time *Terribile* was completed in September 1861, the Sardinian navy had been replaced by the Regia Marina – the Italian Royal Navy. So, she became the first ironclad of this new fleet.

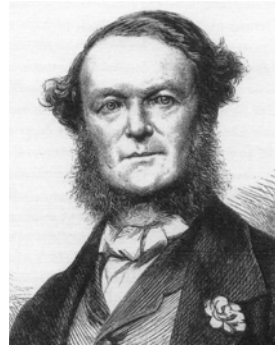
Formidabile-class broadside ironclads | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Terribile	Toulon	June 1860	February 1861	September 1861	Decommissioned 1904
Formidabile	Toulon	December 1860	October 1861	May 1862	Decommissioned 1903
2,618–2,807 tons | Speed: 10kts | Length: 206ft 10in (63m) | Armour: 4.3in (10.9cm) | Guns: 16x6.5in RMLs, 4x8in RMLs					

The Italian government realized the importance of ironclads, and ordered two more to be built in a New York shipyard. These, the *Re d'Italia* and *Re di Portogallo*, were full-sized wooden-hulled ironclads, with a slightly thicker armoured belt than the *Gloire*, which they resembled. They joined the fleet in 1864. Meanwhile two more wooden-hulled ironclads were being built in Italian shipyards, having been converted from wooden frigates. These Principe di Carignano-class ironclads were joined by a third in 1871, which was similar to them, but was built from the keel up as an ironclad. Only the *Principe di Carignano* was completed in time to fight at Lissa. The Regia Marina also built a small flotilla of coastal defence ironclads, two of which, the *Palestro* and *Varese*, also saw action at Lissa.

Re d'Italia-class broadside ironclads | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Re d'Italia	New York	November 1861	April 1863	September 1864	Sunk in action, July 1866
Re di Portogallo	New York	December 1861	August 1863	August 1864	Decommissioned 1875
5,610 tons | Speed: 10.5kts | Length: 326ft 10in (99.6m) | Armour: 4.75in (12.1cm) | Guns: 6x8in RMLs, 32x6.5in RMLs (*Re d'Italia*), 2x10in RMLs, 26x6.5in RMLs (*Re di Portogallo*)					

Principe di Carignano-class broadside ironclads | 3 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Principe di Carignano	Genoa	January 1861	September 1863	June 1865	Decommissioned 1875
Messina	Naples	September 1861	December 1864	February 1867	Decommissioned 1880
Conte Verde	Leghorn	March 1863	July 1867	December 1871	Decommissioned 1880
3,446–3,868 tons | Speed: 10–11kts | Length: 238ft 10in–241ft 10in (72.8–73.7m) | Armour: 4.75in (12.1cm) | Guns: 4x8in SMLs, 22x6.5in RMLs (*Principe di Carignano* 10x8in SMLs, 12x6.5in RMLs)					

In the summer of 1862 the Italian government ordered four more broadside ironclads from French shipyards. These would form the Regina Maria Pia class, built under the direction of Admiral Carlo di Persano. These were iron-hulled ships, the first in the Regia Marina, with a belt armour similar to the *Gloire*. All but one of them were delivered and commissioned in 1864. The fourth, the *Ancona*, joined the fleet in early 1866.



Admiral Carlo di Persano (1806–83) commanded the Italian fleet at the battle of Lissa (1866), and lost the battle, despite enjoying a numerical superiority over his Austro-Hungarian rivals. The lack of control he exerted over his fleet was a significant factor in the Italian defeat.

Regina Maria Pia-class broadside ironclads | 4 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Regina Maria Pia	Toulon	July 1862	April 1863	April 1864	Decommissioned 1904
San Martino	Toulon	July 1862	September 1863	November 1864	Decommissioned 1903
Castelfidardo	St Nazaire	July 1862	August 1863	May 1864	Decommissioned 1910
Ancona	Bordeaux	August 1862	October 1874	April 1866	Decommissioned 1903
4,157–4,201 tons | Speed: 12–13.5kts | Length: 265ft 10in–268ft 4in (81.2–81.8m) | Armour: 4.3–4.75in (10.9–12.1cm) | Guns: 4x8in SMLs, 22x6.5in RMLs (*Ancona* and *Castelfidardo* 4x8in SMLs, 23x6.5in RMLs)					

In early 1863 the wooden-hulled broadside ironclads *Roma* and *Venezia* were laid down in Genoa. Their construction was delayed by financial constraints, and so although *Roma* was launched in 1865 it took another four years to fit her out, while *Venezia* took almost six years to complete. Their designer Giuseppe de Luca had wanted to give them some degree of fore-and-aft fire, but this only happened with *Venezia*. She was modified extensively while still under construction, and emerged as a casemate ironclad. De Luca had solved his fore-and-aft problem by creating recesses in the hull which allowed the bow and stern guns on each beam to fire either forward or astern. So, although the two Roma-class ironclads were similar, one was more modern than the other.

Roma-class broadside ironclad (*Roma*)/casemate ironclad (*Venezia*) | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Roma	Genoa	February 1863	December 1865	May 1869	Decommissioned 1895
Venezia	Genoa	February 1863	January 1869	April 1873	Decommissioned 1895
5,698–6,151 tons | Speed: 13kts | Length: 261ft 5in (79.7m) pp | Armour: 4.75–6in (12.1–15.2cm) | Guns: 5x10in RMLs, 12x8in RMLs *(Roma)*, 18x10in RMLs *(Venezia)*					

In the spring of 1863, work began on the *Affondatore* (Sinker). She was designed by Simone Antonio de Saint-Bon and built on the Thames. Officially she was an iron-hulled ironclad ram, but she also became the Regia Marina's first turret ship. She was protected by 5in (12.7cm) of armour on her turret and hull, and armed with two Armstrong 9in (22.9cm) RMLs mounted in

The Italian fleet, pictured in the port of Ancona shortly before the battle of Lissa (1866). Note that the majority of the ships pictured here are wooden-hulled steam-powered warships – barely a quarter of the fleet's larger vessels were ironclads.

two single turrets, one forward, one aft. Her main weapon, though, was her large iron ram. She was still being fitted out when war broke out in June 1866, but she joined the fleet shortly before Lissa.

Affondatore-class turret ship | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Affondatore	London	April 1863	November 1865	July 1866	Decommissioned 1907
4,006 tons | Speed: 12kts | Length: 307ft 9in (93.8m) | Armour: 5in (12.7cm) | Guns: 2x9in RMLs					

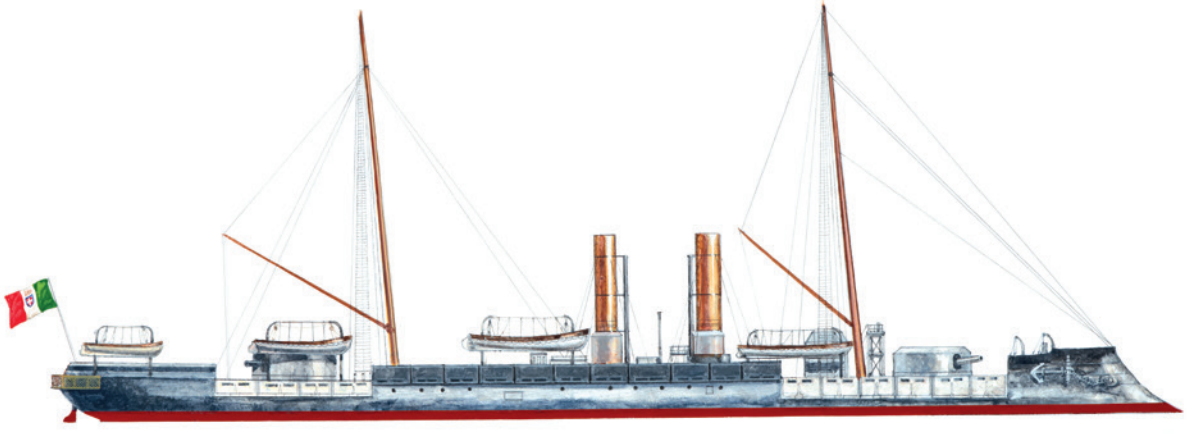
Italy was struggling to produce sufficient iron for her ambitious shipbuilding programme. So, wooden-hulled warships remained in vogue. However, the two casemate ironclads of the Principe Amedeo class designed by de Luca had composite wood and iron hulls, comprising iron frames and iron amidships, with wood at either end. Both the *Principe Amedeo* and *Palestro* were protected by an 8.7in (22cm) belt, making them the best-protected ironclads in the Italian fleet.

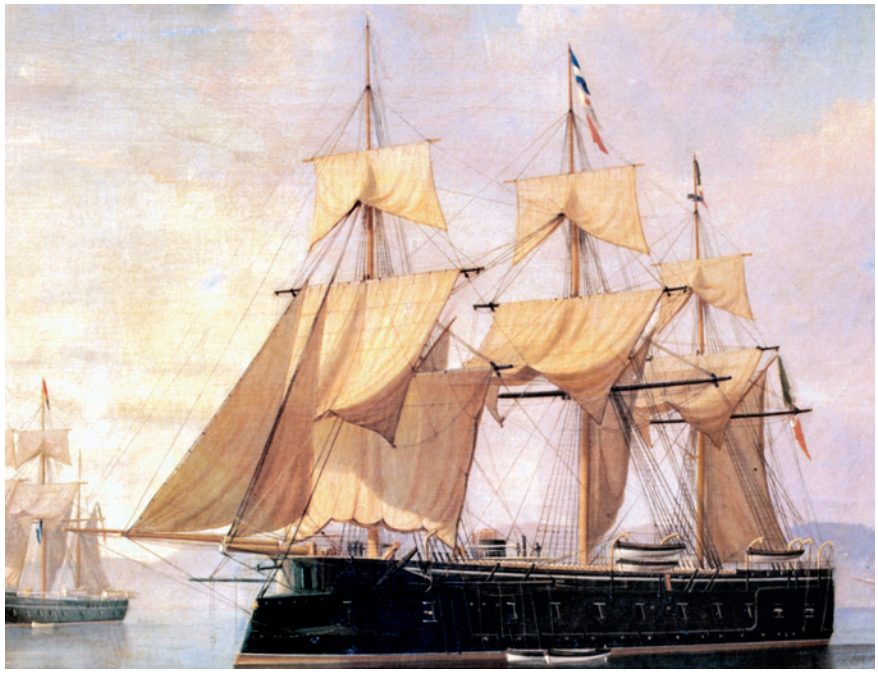
E

ITALIAN IRONCLAD *AFFONDATORE* (1866) AND SPANISH IRONCLAD *NUMANCIA* (1870)

In 1861, when the Italian Regia Marina (Royal Navy) was created, the fleet lacked any ironclads of their own. So, while Italian naval architects and shipbuilders wrestled with the problem of designing and building these in Italy, orders were also placed with French, British and American yards, to speed up the process. While most of these were conventional broadside ironclads, the naval architect Saint-Bon drew up plans for an unarmed ironclad which relied on its powerful ram to sink its foes. This vessel, named *Affondatore* (meaning 'Sinker'), was laid down in Millwall on the Thames in early 1863. During her construction Saint-Bon was persuaded to add guns to her, mounted in two single turrets. Financial problems delayed her completion, and in 1866, when war became imminent, *Affondatore* (top) was moved to Cherbourg to be fitted out. She joined the Italian fleet shortly before the battle of Lissa (1866). Although badly damaged she survived the battle, and remained in service in various guises for another four decades.

The Armada Española (Spanish Navy) had been in decline for much of the early 19th century, but during the 1860s this trend was reversed, and a number of new warships were built. These included a handful of ironclads, built in either Spanish or foreign yards. The *Numancia* (bottom) was ordered from a French shipyard in 1862, and she entered service two years later. She was essentially an enlarged version of the *Gloire*, with a slightly thicker armoured belt, and a longer hull. However, she was armed with a battery of outmoded smoothbore muzzle-loaders (SMLs), and was underpowered. She saw service during the war in the Pacific against Chile and Peru (1864–66), and again during the Carlist War of 1872–76. She remained in service until World War I, when she foundered on her way to the breaker's yard.





The *Principe Amedeo* and her sister *Palestro* were the first composite wood and iron-hulled ironclads to enter service with the Italian navy, and the last to carry a full sailing rig. They were casemate ironclads, although each differed slightly in its layout.

Principe Amedeo-class broadside ironclads | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Palestro	La Spezia	August 1865	September 1871	July 1875	Decommissioned 1900
Principe Amedeo	Naples	August 1865	January 1872	December 1874	Decommissioned 1895
3,446–3,868 tons | Speed: 12–12.5kts | Length: 258ft 7in–261ft 7in (78.8–79.7m) pp | Armour: 5.5–8.7in (14–22cm) | Guns: 1x11in RMLs, 6x10in RMLs					

However, they took almost a decade to build, and were modified while under construction. *Palestro* emerged with three small casemates, rather than one bigger one. This was to provide better all-round fire. Unfortunately these ships were obsolete by the time they entered service in 1874–75. By then the Regia Marina had embarked on a far more ambitious and revolutionary shipbuilding programme. In 1873, work began on Italy's first 'modern' turret ships, the *Duilio* and *Dandolo*. Like the *Devastation* in Britain, these powerful warships would help usher in the era of the modern battleship.

The Netherlands

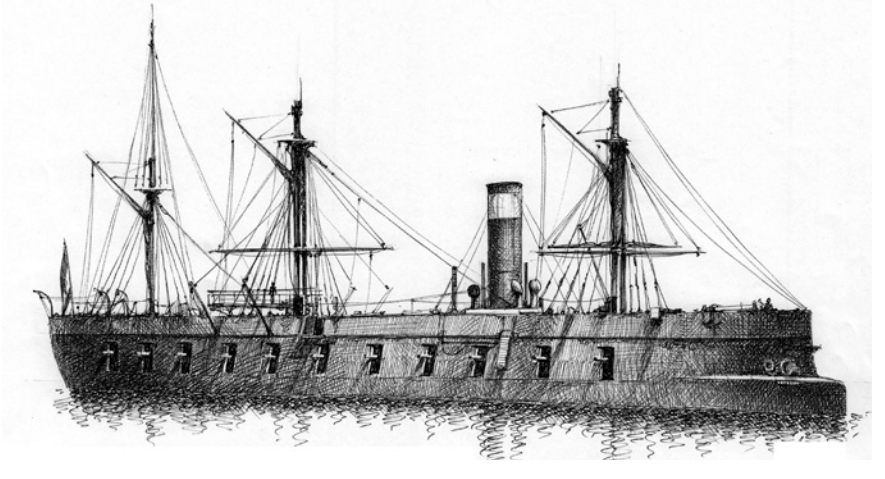
In 1860 the Netherlands was heavily reliant on maritime commence, and maintained overseas colonies in the Caribbean and the East Indies. To defend these the Dutch maintained a steam-powered squadron, supported by smaller gunboats. In 1861 the Dutch Director of Naval Construction, Lambertus Turk, began converting existing warships into floating batteries. The first of these was the *Neptunus*, a vessel plagued by problems, not least of which was her lack of effective armour. Only marginally more successful was the *De Ruyter*, a conversion based on the CSS *Virginia*. She was only commissioned in 1870, by which time she was obsolete. Four years later this badly designed vessel was scrapped.

De Ruyter-class small casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
De Ruyter	Amsterdam	April 1853 (Conversion begun 1863)	June 1855	Summer 1870	Decommissioned 1874
2,828 tons | Speed: 8kts | Length: 211ft 8in (64.5m) | Armour: 2–6in (5.1–15.2cm) | Guns: 14x7in SMLs					

The Dutch then decided they needed ironclads to protect their colonies. While plans were developed, nothing was ordered until 1866. Meanwhile in 1864 they decided to build smaller ironclads to defend Dutch home waters. Both types would be twin-screwed, to cope with local currents, and would be turret ships, equipped with rams. The first of these larger ironclads, the *Prins Hendrik der Nederlanden*, a 3,320-ton turret ship with twin screws, was built in Birkenhead, and completed in 1867. She was a scaled-down version of the British turret ship *Monarch*, armed with four Armstrong 9in (23cm) RMLs, mounted in two twin turrets. Like the original *Monarch* she was a well-designed ship, and remained in active service until 1899.

Prins Hendrik-class turret ship | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Prins Hendrik der Nederlanden	Birkenhead	August 1865	October 1866	March 1867	Decommissioned 1899
3,320 tons | Speed: 11kts | Length: 240ft (73.2m) | Armour: 4.5in (11.4cm) | Guns: 4x9in RMLs					

The first of the smaller ironclads were the two pairs of small mastless turret ships – the Buffel and Schorpioen classes. Each consisted of two ships: *Buffel* (Buffalo) built in Clydebank and *Guinea* built in Amsterdam, and then the *Schorpioen* (Scorpion) and *Stier* (Bull), built in Toulon and Birkenhead respectively. Each carried two Armstrong 9in (23cm) RMLs, mounted in a twin turret forward of the superstructure. These were coastal defence ships, with twin screws and a respectable armour of 6in (15.2cm) and 8–11in (20.3–28cm) over their turrets. Both had long careers, and the *Buffel* and *Schorpioen* still survive as historic ships, on display in Hellevouetsluis (*Buffel*) and Den Helder (*Schorpioen*). These larger coastal defence ships



In 1864 the Dutch navy ordered a turret ship to be built in a British shipyard. The *Prins Hendrik der Nederlanden* was essentially a scaled-down version of the British *Monarch*, and was destined for service in the Dutch East Indies, although she was retained in home waters until 1876. During this period her elegant barque-rigged masts were modified as shown here, and her bowsprit removed, giving her an ungainly but utilitarian appearance.

were augmented by 11 single-turret monitors, most of which were built in the Netherlands.

Buffel-class small turret ships | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Buffel	Clydebank	June 1867	March 1868	July 1868	Decommissioned 1896 Survives as a historic ship
Guinea	Amsterdam	September 1867	May 1870	October 1873	Decommissioned 1897
2,285–2,402 tons | Speed: 11kts | Length: 195ft 10in (59.7m) | Armour: 8in (20.3cm), with 8-11in (20.3–28cm) in turrets | Guns: 2x9in RMLs					

Schorpioen-class small turret ships | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Schorpioen	Toulon	August 1867	January 1868	October 1868	Decommissioned 1909 Survives as a historic ship
Stier	Birkenhead	November 1867	April 1868	November 1898	Decommissioned 1908
2,078–2,402 tons | Speed: 12.5kts | Length: 205ft (62.5m) | Armour: 6in (15.2cm), with 8–11in (20.3–28cm in turrets) | Guns: 2x9in RMLs					

Finally, in 1871, the *Koning der Nederlanden* was laid down in Amsterdam. She would be the largest warship built in Holland until the early 20th century. The three-masted turret ship displaced just over 5,300 tons, and was distinguished by her three funnels and long superstructure, with a twin turret at either end. These carried Armstrong 11in (28cm) RMLs. She was protected by a wrought iron belt up to 8in (20.3cm) thick, and 9–11.5in (23–29cm) protected her turrets. Her two shafts gave her a top speed of 12 knots. She was launched in 1874, and commissioned in early 1877. Still, with the exception of two oceangoing ironclads, the Dutch navy was primarily a coastal defence force.

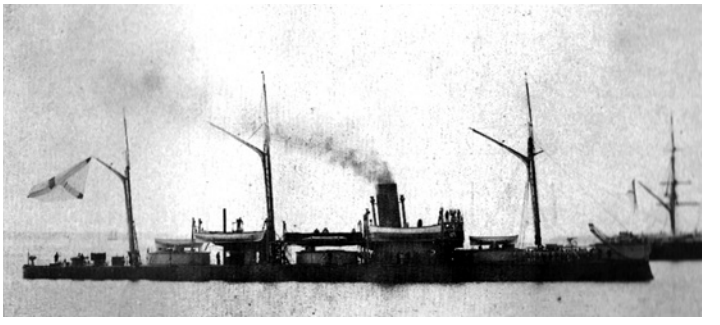
Koning der Nederlanden-class turret ship | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Koning der Nederlanden	Amsterdam	December 1871	October 1874	February 1877	Decommissioned 1899
3,320 tons | Speed: 12kts | Length: 279ft (85m) | Armour: 8in (20.3cm) 9–11.5in (23–29cm) turrets | Guns: 4x11in RMLs					

Russia

The Russian navy has always suffered from geography. By necessity it has to maintain two main fleets, one in the Baltic, and the other in the Black Sea. So, while in 1860 the Imperial Russian Navy was the third-largest fleet in Europe behind Britain and France, this force was divided. The Crimean War had shown that the Russian navy was unequal to the task of defending itself against other larger naval powers. So, after the war the Russian Admiralty, led by General-Admiral Nikolaevitch, set about reviewing the navy's policies, and improving the quality of both its ships and manpower.

During the war, Nikolaevitch had been impressed by the French armoured floating batteries. So, with his encouragement, and the setting aside of suitable funds for naval reform, the Russians were quick to embrace the ironclad revolution. At first they did this by converting steam-powered ships which were already under construction, and by ordering

ironclads from foreign shipyards. Soon, though, ironclads were being built in St Petersburg. The ironclad fleet grew quickly, although many of these new vessels were small coastal defence ships, designed to protect Russia's Baltic coast. Limitations imposed on Russia after the Crimean War meant that her strength in the Black Sea was severely curtailed. In fact the only ironclads sent there during this period were two bizarre circular coastal defence ships.



From 1862 on the Imperial Russian Navy began building small coastal defence ironclads for use in the Baltic. The *Admiral Lazarev*, built in St Petersburg, was a turret ship based on the Prussian *Prinz Adalbert,* and carried four 9in guns, mounted in two twin turrets.

This process of reform began in 1861 with the conversion of the wooden-hulled frigates *Petropavlovsk* and *Sevastopol* into wooden-hulled ironclads. This was done in the naval shipyards of St Petersburg and nearby Kronstadt, where foreign help was called in to augment a workforce unused to the building of such vessels. When completed in 1865–67, both vessels displaced a little over 6,000 tons, and were protected by armour up to 4.5in (11.4cm) thick. Both were broadside ironclads fitted with rams, with 24–28 8in (20.3cm) RMLs in their battery. In addition *Petropavlovsk* carried two (later four) 6in (15.2cm) SMLs, while in 1869 *Sevastopol* was given a single gun of the same type. These ironclads resembled *Gloire* in appearance, and both carried a light sailing rig on three masts, to augment their single engine and screw. These, though, were cumbersome ships, and were never regarded as anything more than self-powered armoured floating batteries.

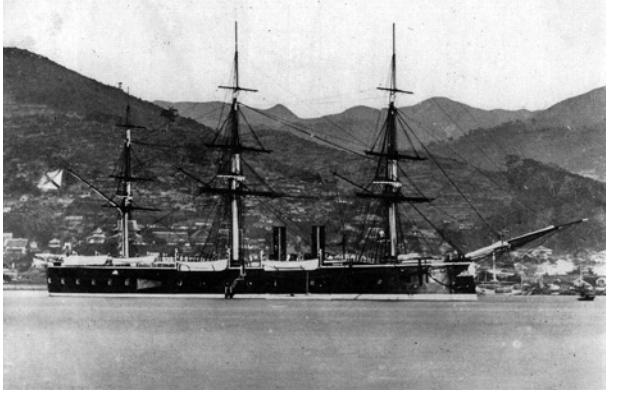
Early broadside ironclads | 2 ships

Ship	Built	Laid Down	Launched	Completed	Fate
Sevastopol	Kronstadt	September 1860 (Conversion began July 1862)	August 1864	July 1865	Decommissioned 1885
Petropavlovsk	St Petersburg	January 1861 (Conversion began October 1861)	August 1865	August 1867	Decommissioned 1885

6,040–6,130 tons | Speed: 12kts | Length: 293–295ft (89.4–89.9m) | Armour: 4.5in (11.4cm) | Guns: 24–28x8in RMLs, 1–4x6in SMLs

In 1870 the *Kniaz Pojarski* became the first casemate ironclad to join the Imperial Russian Fleet. Her heaviest 8in guns were mounted in a central battery, with 6in guns on her upper deck. However, her armoured belt was the same thickness as the French *Gloire*, despite her entering service a decade after the groundbreaking French warship.

The next ironclad was ordered from the Thames Iron Works in London, the same shipyard where the enormous 10,600-ton *Minotaur* was being built for the Royal Navy. The *Pervenetz* (Firstborn) was just a third of the size, but while categorized as a coastal defence ship, she was really a seagoing broadside ironclad of all-iron construction, with a 4.5–5.5in (11.4–14cm) belt, which was sloped too, creating a pronounced tumblehome. This Russian vessel was a broadside ironclad, and, while fairly slow, she was a thoroughly efficient and reliable



addition to the fleet. Essentially *Pervenetz*, as her name reflected, was the first true oceangoing ironclad in the Russian navy.

Pervenetz-class broadside coastal defence ironclads | 3 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Pervenetz	London	December 1861	May 1863	July 1864	Decommissioned 1905
Kreml	St Petersburg	December 1863	August 1865	Summer 1866	Decommissioned 1905
Ne Tron Menya	St Petersburg	December 1863	June 1864	July 1865	Decommissioned 1905
3,277–4,000 tons | Speed: 9–10kts | Length: 221ft 9in–225ft (67.6–68.6m) | Armour: 4.5–5.5in (11.4–14cm) | Guns: *Pervenetz* 26x7.7in SMLs, replaced in 1874 by 12x8in RMLs; *Kreml* and *Ne Tron Menya*: 17x7.7in SMLs, replaced in 1872 by 8x8in and 6x6in RMLs (*Kreml*), or in 1880 by 12x8in and a 9in mortar (*Ne Tron Menya)*					

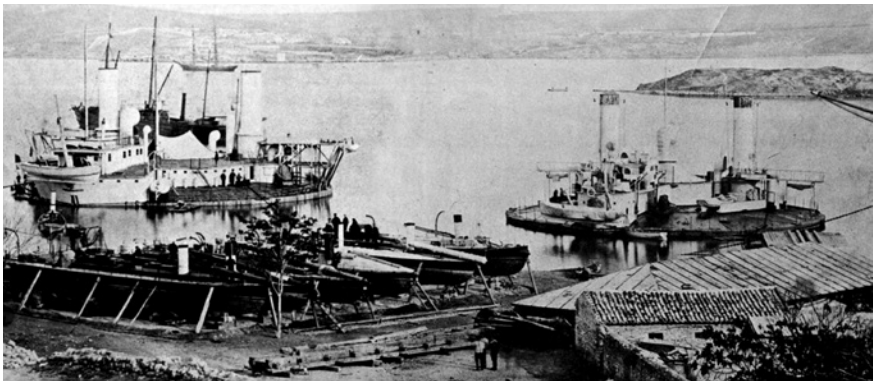
Pervenetz was laid down in late 1861, and completed two years later. By that time work had begun on two sister ships, the *Kreml* (Kremlin) and the *Ne Tron Menya* (Don't Touch Me), which were both built in St Petersburg, although the engine for *Kreml* and the 8in (20.3cm) 68-pdr smoothbores for both ironclads came from Britain. One of these yards, the Mitchell Shipyard in St Petersburg, had been set up by the British shipbuilder Charles Mitchell to provide the Russians with a source of specialist shipbuilding expertise. This British link was also reflected in Russia's next ironclad, the *Kniaz Pojarski*, which was based on plans for the British iron-hulled ironclad corvette *Penelope*, laid down in 1865. By then, the Russian version was already being built, and was launched in the Mitchell Shipyard in 1867.

This ship, the *Kniaz Pojarski*, represented a real step forward. She was a casemate ironclad, with her gun deck protected by an armoured casemate, and with recesses in her hull fore and aft, to allow some degree of fore-and-aft fire. At the time she entered service in 1870, only the latest British and Italian ironclads possessed this feature. So, the Russians were keeping apace with the latest developments. This was also reflected in their next large ironclad, the *Minin*, whose design was based on the British turret ship *Monarch*. Later, *Minin* was modified and converted into an armoured cruiser.

Kniaz Pojarski-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Kniaz Pojarski	St Petersburg	November 1864	September 1867	Spring 1870	Decommissioned 1907
5,131 tons | Speed: 11.5kts | Length: 272ft 8in (83.1m) | Armour: 4.5in (11.4cm) | Guns: 8x8in RMLs, 2x6in RMLs					

Minin-class turret ship | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Minin	St Petersburg	November 1866	November 1869	July 1878	Sunk by mine, August 1915
6,136 tons | Speed: 14kts | Length: 295ft (89.9m) | Armour: 6–7in (15.2–17.8cm) | Guns: 4x8in RMLs, 12x6in RMLs					

The turret also featured in a series of Russian coastal defence monitors, based on those used by the Union navy in the American Civil War. A total of 13 of these were built between 1863 and 1870, followed by four more, larger vessels of the Admiral Lazarev and Admiral Chichagov classes, which



Probably the most unusual ironclads built during this period were the *Vice Admiral Popov* (left) and the slightly smaller *Novgorod*, pictured here off Nikolaev on the Black Sea coast. Both were circular coastal defence ships, and were armed with two open-topped turrets.

resembled the Prussian coastal ironclad *Prinz Adalbert*. However, the most unusual were the two circular coastal defence ironclads built in sections in St Petersburg, and assembled in Nikolaev on the Black Sea. The *Novgorod* and the slightly larger *Admiral Popov* each carried a pair of large guns in a barbette mount. These, however, though novel, were purely coastal defence vessels. By contrast, as they were being assembled on the Black Sea, the Russians were also fitting out a far more potent turret ship – one that would become the forerunner of the modern Russian battle fleet.

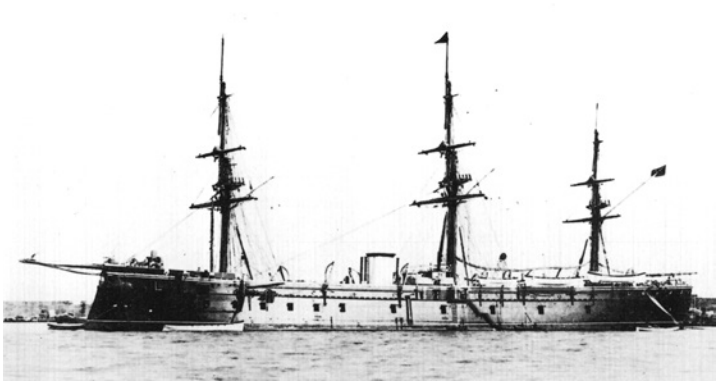
Allegedly, the design for the *Petr Veliki* (Peter the Great) came about following a visit to Russia by the *Miantonomoh*, a US Navy monitor. While this might have been true of the original plans, drawn up in 1867, the design was heavily modified. A more significant influence was the British turret ship *Devastation*, designed by Sir Edward Reed. The *Petr Veliki* took on a similar aspect to her, and was of a comparable size – three times that of the American monitor.

She was built in St Petersburg, and although she was launched in 1872 a series of extensive modifications meant that she only entered service in 1876, after the period covered by this book. However, while she represented a real leap forward – she was Russia's first recognizable 'battleship' – the Russians abandoned the building of capital ships soon afterwards, in favour of smaller but faster armoured cruisers. The *Petr Veliki*, though, showed that the Russians were keeping abreast of developments elsewhere in Europe.

Petr Veliki-class turret ship | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Petr Veliki	St Petersburg	June 1869	August 1872	October 1876	Decommissioned 1922
10,406 tons | Speed: 14kts | Length: 339ft 8in (103.5m) | Armour: 8–14in (20.3–35.6cm) | Guns: 4x12in RMLs					

Spain

The early 19th century hadn't been kind to Spain, due to the loss of most of its empire. By 1860 its once-powerful navy had been reduced to a handful of steam-powered warships, and the rump of a sail-powered fleet. Spain also maintained a number of gunboats to police its remaining territories of Cuba and the Philippines. Still, the Spanish felt they needed to follow France's lead and build their own ironclads, if for no other reason than to maintain their status as a minor naval power. As Spain lacked the



The powerful Spanish broadside ironclad *Numancia* was built in France, but while she resembled the *Gloire* in appearance she was actually iron hulled, and larger than the French vessel. She saw action during the Spanish-South American War of 1864–66.

industrial capacity to produce these ships quickly, it initially turned to foreign shipyards. That left Spanish yards free to convert older wooden warships into ironclads.

The first of the foreign-built ships to be ordered was the *Numancia*, laid down in Toulon in early 1862, and launched late the following year. She was in effect a slightly enlarged iron-hulled version of the French Provence class. When commissioned in early 1865 she carried 40 British 8in (20.3cm) 68pdr. SMLs. She was protected by a 5.5in (14cm) belt, and her French-built engine gave her a top speed of 10 knots. The *Numancia* saw action off Chile and Peru in 1866, and again during the Cartagena uprising of 1873. She also became the first ironclad to circumnavigate the globe.

Two more broadside ironclads, the 6,200-ton *Tetuán* and the 5,700-ton *Arapiles*, were also built on French lines. The *Arapiles* was already being built on the Thames as a wooden-hulled frigate, but in August 1862 she was redesigned as an ironclad. She was completed in 1865, but financial constraints meant that she only joined the fleet three years later. In 1861 the *Tetuán* had been laid down in the Spanish royal dockyard at Ferrol, and she finally entered service in the summer of 1866. Both of these ironclads resembled the Gloire class in terms of armour and machinery, but carried Armstrong RMLs and 7.9in (20cm) Hontoria RBLs.

By 1868, when *Arapiles* entered service, the ironclads *Vitoria* and *Zaragosa* had also joined the fleet. The 7,135-ton iron-hulled *Vitoria* was built on the Thames, and her lines were similar to contemporary British broadside ironclads. She was protected by a 5.5in (14cm) belt, and armed with 32 8.2in (21cm) 69-pdr smoothbores. She was later modified into a casemate ironclad. The smaller wooden-hulled *Zaragosa*, displacing 5,530 tons, was actually designed as a casemate ironclad – the first in the Spanish

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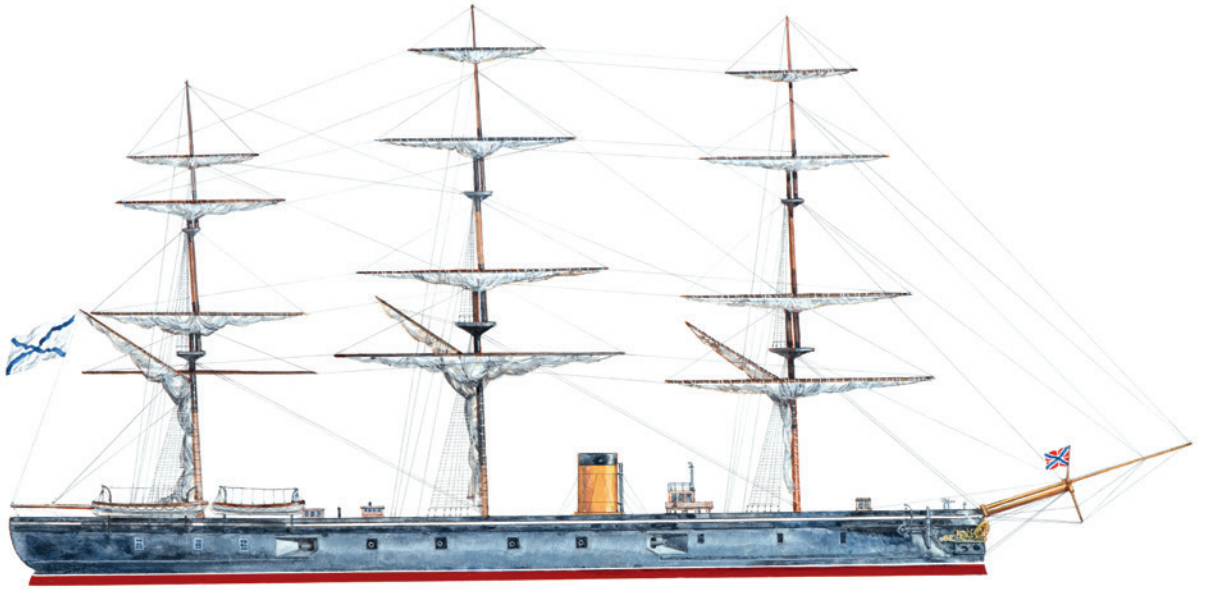
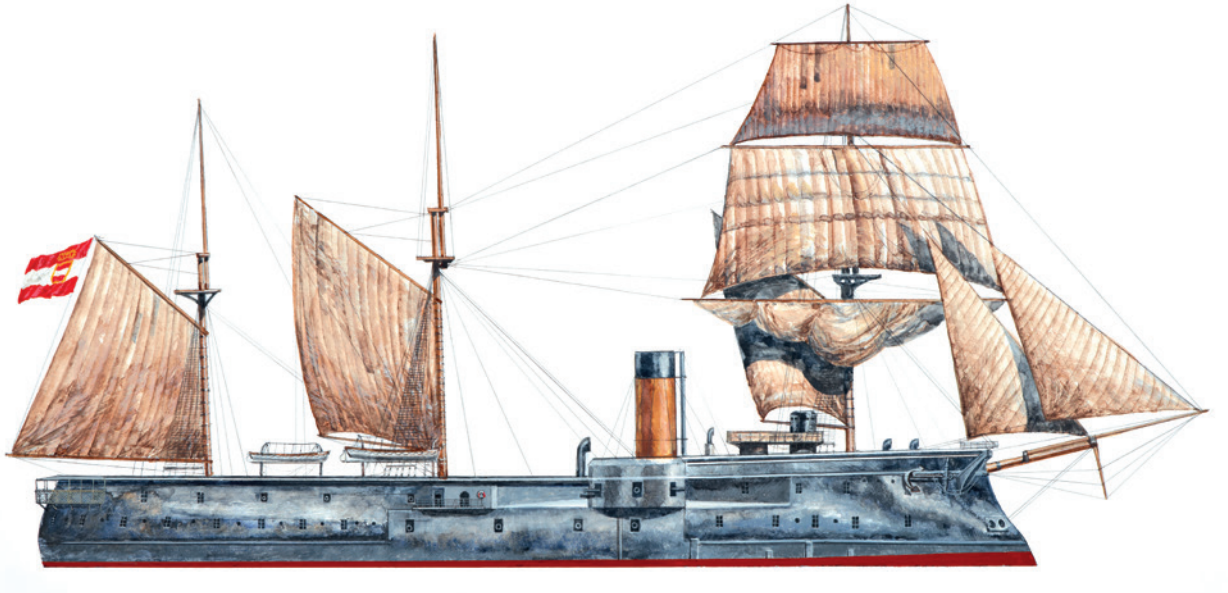
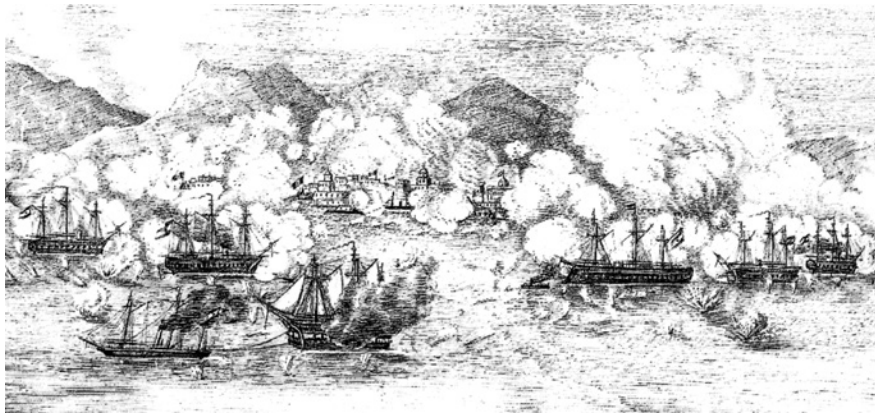
RUSSIAN IRONCLAD *KNIAZ POJARSKI* (1870) AND AUSTRO-HUNGARIAN IRONCLAD *KAISER* (1874)

The Imperial Russian Navy was quick to embrace the ironclad revolution. In 1860 it was the third-largest fleet in Europe, although many of its ships were still obsolete sailing vessels. In 1862 work began on converting a pair of frigates into broadside ironclads, and the building of three iron-hulled coastal defence ironclads. Then, in 1864, work began on the *Kniaz Pojarski* (above), named after a 17th-century Russian military leader. Unlike her two seagoing predecessors she was a purpose-built iron-hulled ironclad, with her heaviest 8in (20.3cm) ordnance concentrated in an armoured casemate, with recesses at either end of it to permit a limited degree of fire fore and aft. She spent much of her career serving with the Baltic Fleet.

At the battle of Lissa (1866) the steam-powered wooden ship-of-the-line *Kaiser* (91 guns) rammed the Italian ironclad *Re di Portogallo*, damaging both ships, and leaving the Austrian warship's figurehead embedded in the enemy hull. After the battle, work began on converting the obsolete ship-of-the-line into a wooden-hulled ironclad. *Kaiser* (below) now had an impressive 6in (15.2cm) wrought-iron belt, tapering to 4in (10.2cm) fore and aft, and backed by her original timbers, which were 26in (66cm) thick. Her guns were now mounted in an armoured casemate, on two decks. She was re-commissioned in late 1873, by which time she was considered outmoded compared to the new generation of ironclads then entering service in other navies. So, within two years she was placed in reserve, and was later converted into a floating barracks.







The Spanish casemate ironclad *Numancia* (centre right), depicted in action during the bombardment of Callao in Peru. This action, fought on 2 May 1866, was the final engagement of the Spanish-South American War (or Chincha Islands War), fought between Spain and Peru, supported by Chile. During this campaign the *Numancia* served as the flagship of Admiral Méndez Núñez.

fleet. She was built in Cartagena, and launched in February 1867. She was commissioned the following year. A belt up to 5in (12.7cm) thick protected her casemate and waterline, with the armour thinning at either end. She carried 21 8in (20.3cm) 68-pdr smoothbores.

Broadside ironclads | 4 ships

Ship	Built	Laid Down	Launched	Completed	Fate
Tetuán	Ferrol	May 1861	March 1863	January 1866	Deliberately blown up, December 1873
Arapiles	London	June 1861	October 1864	Winter 1865	Decommissioned 1879
Numancia	Toulon	April 1862	November 1863	December 1864	Decommissioned 1911
Vitoria	London	January 1863	November 1865	May 1867	Decommissioned 1911

5,700–7,189 tons | Speed: 10–12kts | Length: 315ft (96m) | Armour: 4.25–5.5in (10.8–14cm) | Guns: varied

Casemate ironclads | 2 ships

Ship	Built	Laid Down	Launched	Completed	Fate
Zaragosa	Cartagena	October 1861	February 1867	June 1868	Decommissioned 1896
Sagunto	Ferrol	March 1863	April 1869	February 1877	Decommissioned 1891

5,530–7,352 tons | Speed: 8kts | Length: 280–294ft (85.3–89.6m) | Armour: 4–6in (10.2–15.2cm) | Guns: 21x 8in. SMLs (*Zaragosa*), 6x9in, 2x8in SMLs, 3x7.9in RBL (*Sagunto*)

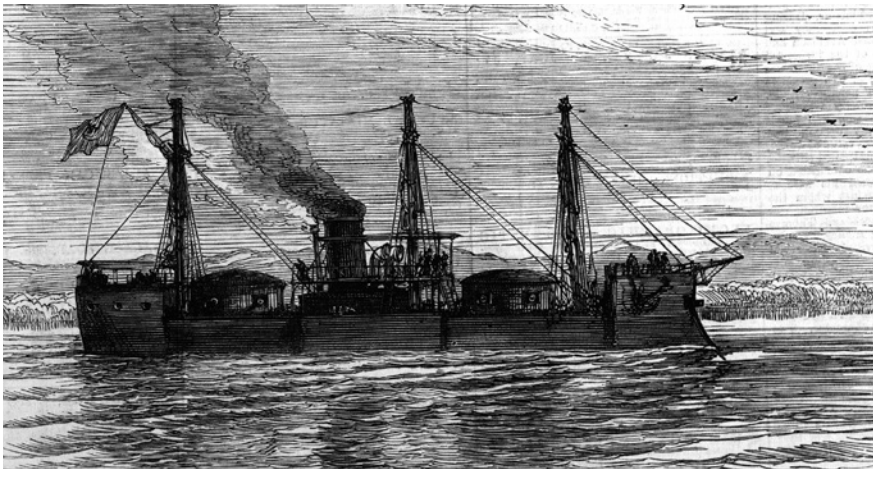
In 1870 these five ironclads were joined by another, the *Méndez Núñez*, which was converted from the steam-powered wooden-hulled frigate *Resolución* between 1867 and 1870. The result was a small casemate ironclad of just under 3,400 tons, with a similar belt to the *Tetuán*'s. She was armed with two 8in (20.3cm) and four 9in (22.9cm) Armstrong RMLs. Another larger ironclad, the *Sagunto*, was converted from a Spanish ship-of-the-line, but she took almost 14 years to complete, and entered service in 1877. Finally, during the early 1870s the Spanish ordered or built two coastal defence ships: the French-built twin-turreted monitor *Puigcerdá*, and the *Duque de Tetuá*, a floating battery built in Ferrol. They were commissioned in 1874 and 1875 respectively, but neither proved particularly good warships.

Small casemate ironclad | 1 ship					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Méndez Núñez	Ferrol	September 1859 (Conversion began 1867)	August 1869	February 1870	Decommissioned 1896
3,382 tons | Speed: 8kts | Length: 236ft 3in (72m) | Armour: 5in (12.7cm) | Guns: 4x9in RMLs, 2x8in RMLs					

Turkey

Although Ottoman Turkey was often derided as 'The Sick Man of Europe', its sultan still ruled over a vast area, stretching from the Balkans to the Persian Gulf. While its naval power had been greatly reduced by the Russians at the battle of Sinope (1853), it still possessed a sizeable steam-powered fleet. Under Sultan Abdul Aziz (reigned 1861–76) the navy embarked on a modest expansion programme, which centred on the building of Turkish ironclads in foreign shipyards. The first of these were the four broadside ironclads of the Osmanieh class, all of which were built in Britain. These substantial 6,400-ton ships were iron hulled, protected by a belt of up to 5.5in (14cm), and armed with 14 Armstrong 8in (20.3cm) RMLs, with an additional 9in (22.9cm) RML pivot-mounted on the fo'c's'le. All four ironclads, *Osmanieh, Abdul Aziz, Mahmudieh and Orhanieh,* entered service in 1864–65.

Osmanieh-class broadside ironclads | 4 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Osmanieh	Clydebank	March 1863	September 1864	November 1865	Decommissioned 1911
Abdul Aziz	Clydebank	May 1863	January 1865	August 1865	Decommissioned 1911
Mahmudieh	London	Spring 1863	December 1864	December 1865	Decommissioned 1911
Orhanieh	Clydebank	Spring 1863	June 1865	July 1866	Decommissioned 1911
6,400 tons | Speed: 12kts | Length: 293ft (89.3m) | Armour: 3–5.5in (7.7–14cm) | Guns: 1x9in RMLs, 14x8in RMLs					



The small iron-hulled turret ship *Lutfi Djelil* was one of several ironclads ordered for the Turkish navy by Sultan Aziz, and built in British or French shipyards. She was blown up while in action against the Russians on the Danube in 1877.

This placed a strain on Turkish finances. So, although an even larger ironclad, the *Fatikh*, was ordered from a British shipyard, the Turkish government sold the unfinished ship to Germany, where she became the *König Wilhelm*. The building of the 4,687-ton *Asar-i-Tevfik* continued, though, and she was duly launched in Toulon in 1868. She was iron hulled, with six Armstrong 9in (22.9cm) RMLs on her gun deck, and two more mounted in upper deck barbettes. In 1866 the Turks ordered the first of eight coastal defence ships. The two Asar-i-Sevket-class and two Lüft-ü Celil-class ships were all built in France, and launched in 1868. The *Asar-i-Sevket* and *Necm-i-Sevket* were small casemate ironclads, carrying five guns apiece, while the *Lüft-ü Celil* and *Hifz-ur-Rahman* were turret ships, armed with two 8in (20.3cm) RMLs mounted in a twin turret.

Asar-i-Tevfik-class casemate ironclad | 1 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Asar-i-Tevfik	Toulon	1867	1868	August 1868	Wrecked, 1913
4,687 tons | Speed: 13kts | Length: 272ft 4in (83m) | Armour: 6–8in (15.2–20.3cm) | Guns: 8x9in RMLs					

Asar-i- Sevket-class small casemate ironclads | 2 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Asar-i Sevket	Toulon	Spring 1867	Summer 1868	March 1870	Decommissioned 1903
Necm-i-Sevket	Toulon	Spring 1867	Autumn 1868	March 1870	Decommissioned 1929
2,047 tons | Speed: 12kts | Length: 203ft 5in (62m) | Armour: 4.5–6in (11.4–15.2cm) | Guns: 1x9in RMLs, 4x7in RMLs					

Lüft-ü Celil-class small turret ships | 2 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Lüft-ü Celil	Bordeaux	Summer 1867	Autumn 1868	March 1870	Sunk in action, 1877
Hifz-ur-Rahman	Bordeaux	Summer 1867	Winter 1868	March 1870	Decommissioned 1900
2,540 tons | Speed: 12kts | Length: 204ft (62.2m) | Armour: 5.5in (14cm) | Guns: 2x8in RMLs, 2x7in RMLs					

Four more small casemate ironclads of the Avnillah and Feth-i-Bülend classes were also iron hulled, three of which were built in Britain, and the fourth (the *Mukaddeme-i-Hayir*) in Constantinople. All carried four Armstrong 9in (22.9cm) RMLs mounted in a central casemate, protected by 6in (15.2cm) of armour in the *Avnillah* and *Muin-i-Zafer*, and up to 9in (22.9cm) in the *Feth-i-Bülend* and *Mukkaddeme-i-Hayir*. Finally the *Iclaliye* was built in Trieste, and was another small casemate ironclad, with two Armstrong 7in (17.8cm) and two 9in (22.9cm) RMLs in her casemate, and another 7in gun mounted in a barbette on her upper deck. The result was that by 1875, two years before the Russo-Turkish War (1877–78) began, the Turks had 14 ironclads in service. In addition, another two large casemate ironclads of the Mesûdiye class were under construction in London, although one of these was purchased by the Royal Navy before her completion, and became HMS *Superb*.

Avnillah-class small casemate ironclads | 2 in class

Ship	Built	Laid Down	Launched	Completed	Fate
Avnillah	London	Autumn 1868	April 1869	Autumn 1870	Sunk in action, 1912
Muin-i-Zafer	London	Autumn 1868	June 1869	Autumn 1870	Decommissioned 1922
2,362 tons | Speed: 12kts | Length: 226ft (69m) | Armour: 5–6in (12.7–15.2cm) | Guns: 4x9in RMLs					

Feth-i-Bülend-class small casemate ironclads | 2 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Feth-i-Bülend	London	May 1868	Summer 1869	Winter 1870	Sunk in action, 1912
Mukaddemi-i-Hayir	Constantinople	1870	October 1872	Summer 1874	Decommissioned 1922
2,761 tons | Speed: 12–13kts | Length: 236ft 3in (72m) | Armour: 6–9in (15.2–22.9cm) | Guns: 4x9in RMLs					

Iclaliye-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Iclaliye	Trieste	May 1868	Winter 1869	February 1871	Decommissioned 1922
2,266 tons | Speed: 12kts | Length: 213ft 3in (65m) | Armour: 4.5–6in (11.4–15.2cm) | Guns: 2x9in RMLs, 3x7in RMLs					

Mesûdiye-class casemate ironclad | 1 in class					
Ship	**Built**	**Laid Down**	**Launched**	**Completed**	**Fate**
Mesûdiye	London	Winter 1872	October 1874	December 1875	Sunk in action, 1914
9,120 tons | Speed: 13.5kts | Length: 331ft 5in (101m) | Armour: 6–12in (15.2–30.5cm) | Guns: 12x10in, 3x7in					

IRONCLADS IN ACTION

Despite the growing number of ironclads being built in Europe, these warships took part in only one major sea battle during this period. Even small actions such as the duel between the Danish *Rolf Krake* and Prussian batteries were a rarity. So, to understand how these ironclads fared in action, we really have to look at their performance during the battle of Lissa, fought in the Adriatic on 20 July 1866. The protagonists were the fleets of Austria-Hungary and Italy, both of which largely consisted of wooden-hulled warships, spearheaded by a squadron of ironclads. This is not the place for a full account of the battle, which in any case is amply covered in Wilson (1896), Greene & Massignani (1998) and Freivogel (2017). In this brief account we shall concentrate on the way the ironclads were used, and how they performed.

At 7.00am, when the Austrian fleet was first sighted, the Italian fleet was scattered around the coast of the island of Lissa, which it had been bombarding since the previous day. Admiral di Persano gathered his ten available ironclads into a line abreast formation, as rain squalls hid the approaching fleets from sight. He then decided to reverse course and form a line astern formation, to make the best use of his superiority in guns. When the Austrians re-appeared to the north-west at 9.30am the Italians were in a straggling line, heading towards the north-east. This was no ordered battle line, but rather three clumps of ironclads, with large gaps between them.

Persano's opponent, Rear-Admiral Tegetthoff, had deployed his seven ironclads into a wedge formation, and approached the enemy line at right angles. His wooden-hulled warships followed behind the ironclads. By contrast the Italian wooden warships took no active part in the coming battle, nor did the small ironclads *Formidabile* and *Terribile*. Tegetthoff aimed his wedge at the gap between the leading three Italian ironclads

Rear-Admiral Wilhelm Tegetthoff (1827–71) led the Austro-Hungarian fleet to victory at the battle of Lissa (1866). He relied on the rams of his ironclads to win the battle, as a means of countering the superior firepower of his Italian opponents.

(*Carignano*, *Castelfidardo* and *Ancona*) and the main body, 2 miles (3.2km) astern of them. This consisted of the flagship *Re d'Italia*, along with the *Affondatore, Palestro* and *San Martino*. Further astern were the *Re di Portogallo* and *Maria Pia*, with the *Varese* steaming up to join them. Strangely, just 15 minutes before the fleets clashed, Persano moved his flag to the *Affondatore*. Most of his captains were unaware of this, and so effectively the Italian fleet was left leaderless at the critical moment.

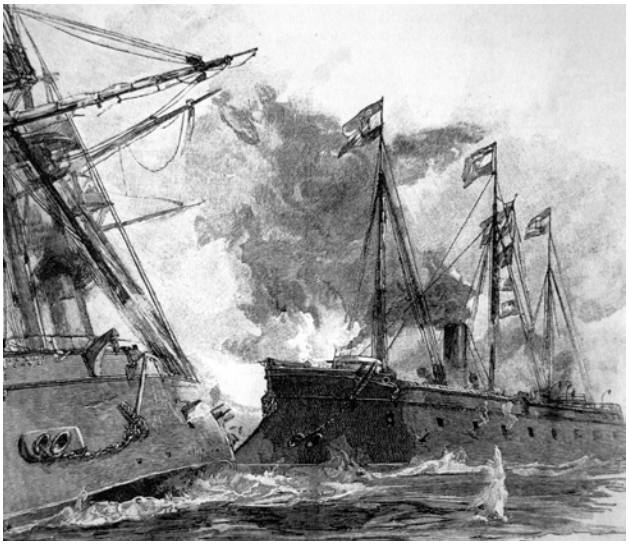
By contrast, Tegetthoff sent a clear signal to his captains – 'Ironclads to charge the enemy and sink him'. While the Italians were relying on gunnery, the Austrians expected the ram to win the day. At 10.43am the Italian ships began firing at the approaching Austrians, at a range of about 1,000 yards (914m). However, due to a lack of gunnery training few if any hits were scored. Most shots went over their targets. The resulting thick smoke soon made it difficult to see the enemy, and so ten minutes later when the Austrian ironclads breached the Italian line, they passed through it without finding any targets to ram. As Tegetthoff turned his ironclads around for another pass, his wooden warships headed south, to engage the aftermost three ironclads in the Italian line.

When contact was made, the two sides could be identified by colour – the Austrian hulls were black, while the Italian ones were grey. So, Tegetthoff signalled 'Ram anything grey', as his ships went in search of victims. The *Re d'Italia, Palestro* and *San Martino* were in their path, and, with visibility limited by the smoke, both sides fired at close range at their opponents, as the Austrians manoeuvred to ram their Italian counterparts. A glancing blow damaged the rudder of the *Re d'Italia,* and Tegetthoff's flagship *Erzherzog Ferdinand Max* took advantage of this; after one failed attempt the Austrian ironclad struck the *Re d'Italia* amidships on her port side. The *Erzherzog Ferdinand Max* backed away, leaving the *Re d'Italia* holed and sinking. She went down with flags flying.

G

THE RAMMING OF THE *RE D'ITALIA*, BATTLE OF LISSA, 20 JULY 1866

In early 1866, Italy and Prussia forged a military alliance, and so in June, three days after Prussia declared war on Austria-Hungary, the Italians followed suit. By July, as the Italian land offensive stalled, the Italian fleet were ordered to act more aggressively in the Adriatic. So, Admiral Persano led an invasion of the Austrian-held island of Lissa (now Vis). The Italians were actually engaged in landing troops there when the Austrian fleet appeared, and headed straight towards the unprepared Italian fleet. The battle that followed was a swirling scrap, in which the larger but strung-out Italian fleet placed its faith in gunnery, while the Austrian commander Rear-Admiral Tegetthoff relied on ramming to win the day. At the battle's height the Austrian flagship *Erzherzog Ferdinand Max* tried to ram the Italian ironclad *Re d'Italia*, but scored only a glancing blow. As several ironclads of both sides circled each other amid the thick smoke, Tegetthoff saw that the *Re d'Italia* had slowed down to avoid a collision. The *Erzherzog Ferdinand Max* surged forward and struck the *Re d'Italia* on her port side, a little forward of midships. Her ram carved an 18ft (5.5m) gash in the Italian ship's side, and as the Austrian ironclad reversed engines the *Re d'Italia* began to sink. This scene captures the key moment of the battle. The *Re d'Italia* sank shortly afterwards, taking some 400 of her crew with her.



At the height of the battle of Lissa (1866) the Austro-Hungarian ironclad *Erzherzog Ferdinand Max* rammed the near-stationary Italian ironclad *Re d'Italia* amidships on her port side. The Austrian ram tore a hole in her target below the waterline, and when she pulled clear out of the way the Italian ironclad heeled over and sank. To many naval experts of the period, this clearly demonstrated the value of the ram in naval combat.

At the same time the battered and burning *Palestro* turned away from the fight, as did the *Ancona*, which was also blazing fiercely. At that point Tegetthoff ordered his ironclads to 'Support the second division' – which meant his wooden warships. While this first melee had been playing itself out, the Austrian wooden ships had been fighting the *Re di Portogallo*, *Maria Pia* and *Varese*. The Austrian wooden ship-of-the-line *Kaiser* rammed the *Re di Portogallo*, which left the Austrian ship's figurehead embedded in the ironclad's side. The *Kaiser* was badly mauled, but the Italian ironclad was damaged too. Persano in the *Affondatore* did what he could to protect his remaining ironclads, but eventually he ordered his now battered fleet to withdraw from the fight.

This Austrian victory was won at the cost of just 38 sailors killed. By contrast the Italians lost 408 men in the *Re d'Italia*, and another 204 when the *Palestro* blew up when her fires reached her magazines. The fight lasted just over two hours. The battle led to Persano's disgrace and dismissal, and to the general belief that the ram had triumphed over the gun. This gave rise to an inflated opinion of the efficacy of ramming tactics which would last for two decades. In fact, despite numerous ramming attempts, only one was truly successful, and even then the *Re d'Italia* had been damaged beforehand. The poor performance of Italian gunnery was due more to poor training than to potential firepower, but the battle also spurred designers to develop larger guns, capable of inflicting more damage on enemy ironclads than had been achieved during the battle, even when firing at point-blank range.

Another depiction of the sinking of the Italian ironclad *Re d'Italia* at the battle of Lissa (1866). Behind her can be seen the ironclads of the Austro-Hungarian fleet, including the *Erzherzog Ferdinand Max* (centre). This incident encouraged naval designers to introduce watertight compartments into newly built iron-hulled vessels.

So, despite its being the only real sea battle of the ironclad age, at least in European waters, the lessons this fight provided were of dubious value. In fact, by the mid-1870s, improvements in both ordnance and armour had made the post-Lissa generation of ironclads much less vulnerable to ramming tactics, and much more capable of damaging an opponent, if only the gunners were trained sufficiently to actually hit their target. During the mid-1870s many European ironclads were modernized, and fitted with larger guns and in some cases thicker armour. This prolonged their service life, an important consideration as it often took several years to build a new ironclad from the keel up.

For example, the Kaiser Max class were extensively refitted in 1874–77, and emerged with a belt twice as thick as before, and a powerful battery of Krupp RBLs. This, more than anything, helped underline the danger of relying on ramming tactics, in an age when ordnance was becoming both increasingly powerful and more accurate. It also marked the start of a new age, where steel battleships would replace ironclads, and guns became the undisputed arbiters of victory.

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